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Index to the

Bell Telephone Magazine

Volume XXXI, 1952

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AMERICAN TELEPHONE AND TELEGRAPH COMPANY
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BELL TELEPHONE MAGAZINE

VOLUME XXXI, 1952

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Bell Telephone MAGAZINE

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Winter 1953
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• *Three Decades of Publication* •

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A Medium of Suggestion & A Record of Progress

JUDSON S. BRADLEY, *Editor.* *Published four times a year for the supervisory forces of the Bell System by the Public Relations Department of the*
AMERICAN TELEPHONE AND TELEGRAPH CO., *195 Broadway, New York 7, N. Y.*
CLEO F. CRAIG, *President;* CARROLL O. BICKELHAUPT, *Sec.;* DONALD R. BELCHER, *Treas.*

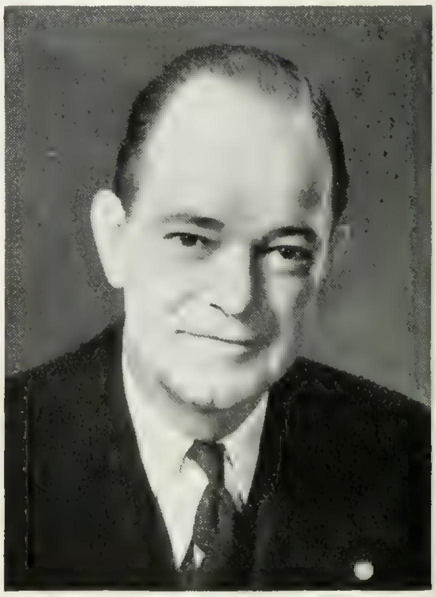
Who's Who & What's What
in This Issue

It seems to be characteristic of Long Lines people that they move around as they move ahead. Certainly Henry T. Killingsworth's telephone career bears out that observation. He joined the Department as a technical employee in 1919, and worked on matters concerning inductive coördination in Atlanta and other parts of the South for six years before moving to New York as an engineer. His subsequent moves and responsibilities followed this pattern: to Cleveland in 1928 as division plant engineer; to Denver in 1936 as division plant superintendent; back to New York in 1940 as general plant supervisor; to Atlanta in 1945 as general plant superintendent, in conjunction with the formation of the Southern Area; and to New York again in 1948 as general manager of Long Lines. He became top man at Long Lines in 1949 when he was elected a Vice President of A. T. & T. and placed in charge of the Department. (The picture on page 6 is from Black Star, the one on page 10 is from Philip Gendreau, and those on pages 14 and 15 are from Ewing Galloway.)

The topic and scope of George L. Best's contribution to this issue indicate in some degree how broad are his vice-presidential interests in the field of business research affecting the future of the telephone industry. His first telephone job was with the New York Telephone Company, in 1922, as an assistant engineer in the Commercial Department. He moved through rate and other commercial positions until 1929, when he became general commercial engineer in Brooklyn. Eight years later he transferred to the Commercial Division of A. T. & T.'s Department of Operation and Engineering, and became successively rate engineer, commercial engineer, and assistant vice president. In 1946 he was elected Vice President of the Western Electric Company, in charge of patent licensing, and in 1948 was made Vice

Henry T. Killingsworth

George L. Best



Keith S. McHugh

Justin J. Murphy

Elizabeth Wrenshall

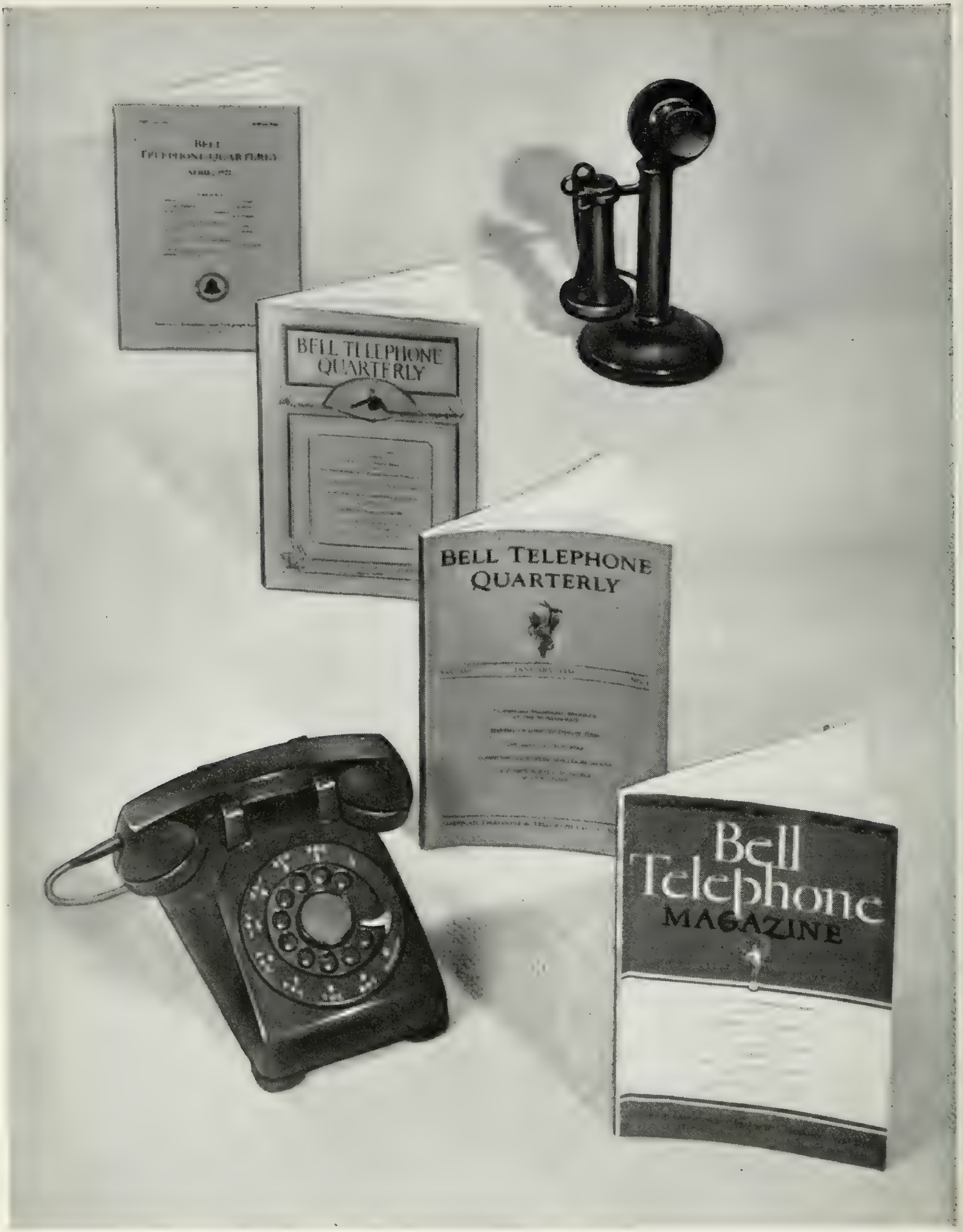
President—Finance. He returned to A. T. & T. as Vice President in 1950, and now heads "Administration-B" Department. With Keith S. McHugh, he contributed "The Bell System's Interest in Program Television" to this MAGAZINE for Spring 1944.

ENTERING the American Telephone and Telegraph Company in 1919 as a clerk, KEITH S. MCHUGH became within a few months an engineer in the O. & E. Department. From 1921 to 1925 he was general commercial engineer of the Chesapeake and Potomac Telephone Company in Washington. For the next four years he was with the New York Telephone Company as general commercial manager, first in the Company's Upstate and then in its Long Island Area, and as Vice President (Public Relations). In 1929 he returned to A. T. & T. as commercial engineer, was appointed an assistant vice president in 1934, and was elected a Vice President in Administration in 1938. In 1946 he was appointed Vice President in charge of Public Relations, and two years later became Vice President in charge of Accounts and Finance. He was elected President of the New York Telephone Company in 1949. Mr. McHugh's interest in civic affairs and business associations is exemplified by his address to the American Management Association. His most recent contribution to these pages was "Bell System Patents and Patent Licensing," in the Winter 1948–49 issue.

BETWEEN 1929, when JUSTIN J. MURPHY began his telephone career with the New York Telephone Company, and 1945, when he transferred to the A. T. & T. Company, he had been business office representative, field sales supervisor, office manager, local manager, and district manager—all in the Manhattan-Bronx-Westchester Area. He was then for about six months in the Commercial Division of A. T. & T.'s O. and E. Department, in the personnel section. Returning to the New York Company in 1946, he was division manager successively in the M-B-W and Long Island Areas. Then, in 1951, he came back to O. & E., where he is now sales and servicing engineer. He and the men reporting to him have inspected 80 per cent of the large camps, as well as many of the small installations, of the kind he describes, and have traveled between 75,000 and 100,000 miles in visiting them and the telephone companies in whose territories they lie.

MUCH of the information received from

(*Continued on page 27*)



Three Decades of Publication

A copy of the first issue of this quarterly periodical appears at the upper left in this picture. Its dress was modest gray and black, and it was dated April 1922. A more elaborate cover in gray and blue was standardized in October 1924, and was succeeded in January 1934 by one in two tones of blue. "Quarterly" became "Magazine" in January 1941, and the current cover, using a different color scheme each time, was adopted with the first issue in 1943 These changes in cover design during thirty years suggest the editorial changes which have taken place in the same period

Three Decades of Publication

THE FIRST NUMBER of the BELL TELEPHONE QUARTERLY appeared in April 1922—just thirty years ago.

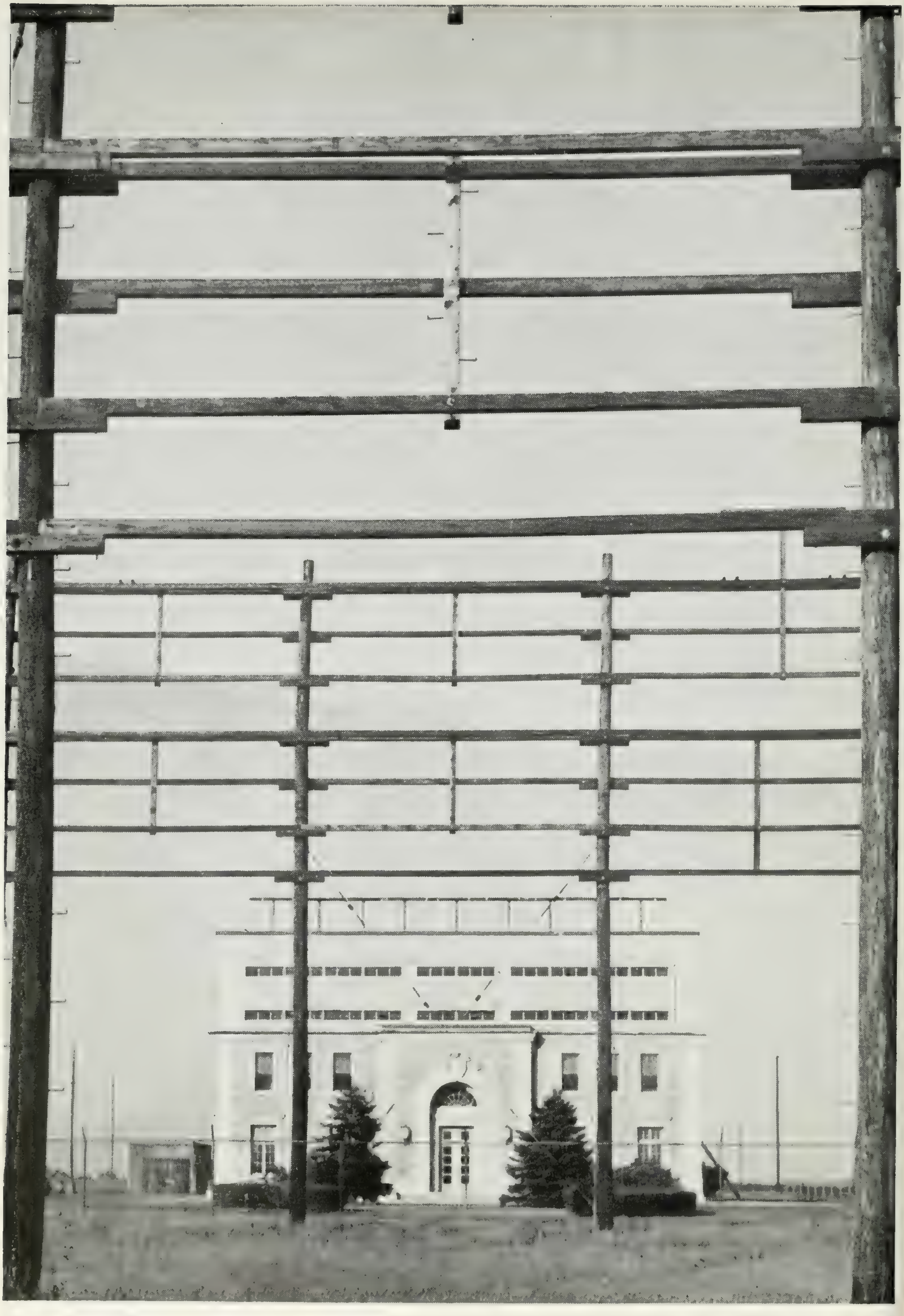
In his "Foreword" to Volume I Number 1 (shown at the upper left on the opposite page), President Harry B. Thayer of the American Telephone and Telegraph Company characterized the Bell Telephone System as a young, active, and progressive institution, continually doing new things. It would be the function of the QUARTERLY, he said, to keep the officers of the Bell System Companies informed about important new things of every kind. He called it "a medium of suggestion and a record of progress," and those words have appeared on the first page of every issue since that day.

This publication has tried to keep pace with what is still a young, active, and progressive organization. The succession of cover designs illustrated at the left may perhaps suggest that there has also been editorial progress within them. Indeed, the name was changed from QUARTERLY to MAGAZINE in 1941 as more representative of its broadening interests.

The motto Mr. Thayer bestowed upon us thirty years ago has done good service. We have recorded and described Bell System progress of many kinds, and that in itself has made the publication a medium which suggests how forward-looking is the organization, how manifold are its contributions to the life of our nation, and how important is the work of every one of us. This MAGAZINE hopes, therefore, to continue to serve as

A Medium of Suggestion and a Record of Progress.

THE EDITORS



The main radio telephone transmitting station at Lawrenceville, N. J., seen through a framework of transmission lines leading to the various antennas

A Single Link between New York and London Has Grown In a Quarter Century to Connections with Ninety Countries And Territories Which Handled 900,000 Calls in 1951

Overseas Telephone Service Is Twenty-five Years Old

Henry T. Killingsworth

THE SILVER ANNIVERSARY of the Bell System's overseas telephone service occurred on January 7, 1952. Since that day twenty-five years ago when New York and London were first connected by voice for commercial telephone service, this service has spread to the farthest reaches of the globe, and now is available to almost all the telephones in the world. Only 2,300 overseas connections were made in 1927, but in the twenty-four ensuing years this annual usage has increased until 900,000 calls were established during 1951 with the 90 other countries and territories now reached by the service.

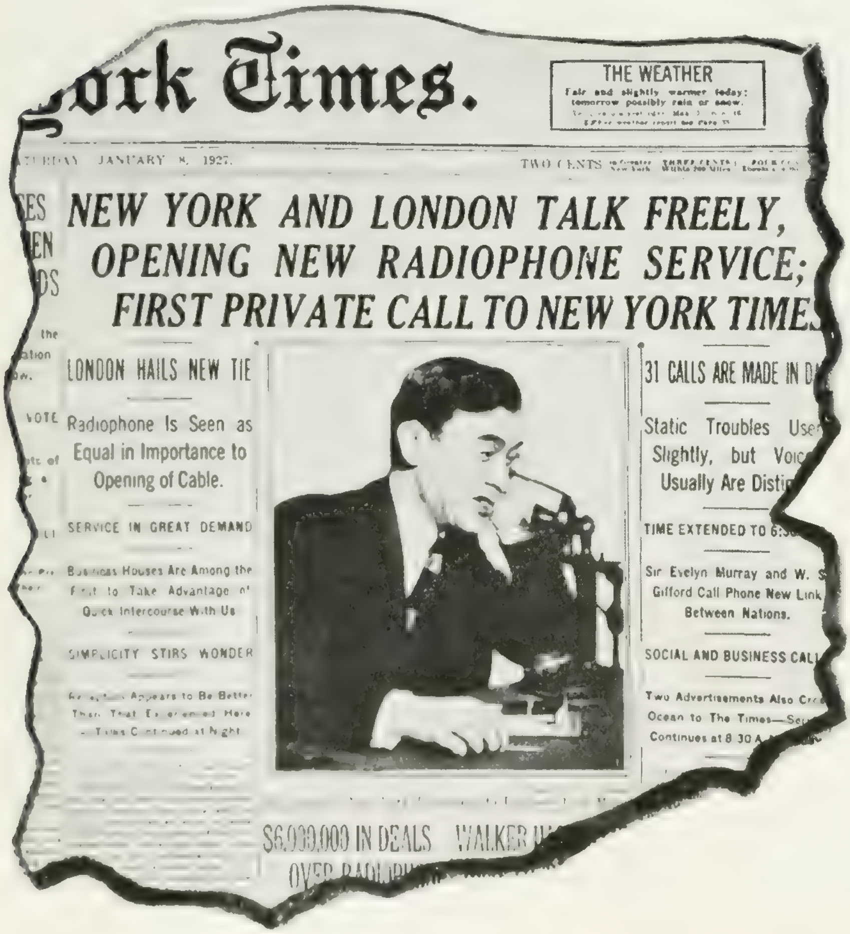
Many people are inclined still to think of talking across the seas as something rather new, yet overseas service has actually been in operation for one-third of the entire life of the telephone. Despite differences in time or language, despite atmospheric conditions that affect radiotelephony more than other means of communication, and despite other special problems related to this service, it has become an effective and important factor in the business, political, and social ties between nations.

The initial New York–London call in 1927 was the successful culmination of the long period of experimentation begun just after the high-vacuum tube was developed in 1914. The service was soon extended to all the United States over the nation-wide network of toll lines spreading beyond the radio terminals. Similarly, by utilizing the extensive telephone networks radiating from London, other cities in Great Britain and also in the principal European countries were reached. North, south, east and west—the march of overseas telephony had begun.

To avoid haphazard expansion, a fundamental plan was formulated soon after the service was inaugurated. The basic objective of the plan was to link the United States with the rest of the world as rapidly as technical progress and traffic requirements should warrant. This objective has been kept constantly in sight, and, as a consequence, telephone service has been extended steadily and in orderly fashion to country after country on all continents, despite changing world conditions which have taken us through the cycles of peace and war.

By the early '30s, trans-world telephony had reached each of the great continents and the principal islands of the globe. This growth was dramatized on April 25, 1935, when a 'round-the-world circuit was established over links of radio and land lines extending from New York to London, Amsterdam, Bandoeng (Java), San Francisco, and back to New York again. Walter S. Gifford, then President of the A. T. and T. Company, and the late Theodore G. Miller, at that time head of the Long Lines Department, talked to each other over that long and historic voice highway from adjoining rooms at Long Lines headquarters in New York.

Mr. Gifford, who opened the London service in 1927, took part last January 7 in still another ceremonial conference call, this one marking the twenty-fifth anniversary of the service. Introduced by Cleo F. Craig, President of the A. T. and T. Company, who spoke from New York, Mr. Gifford, now Ambassador to the Court of St. James's, talked from Washington with Lord Salisbury, Lord Privy Seal, in London. In turn, Mr. Craig spoke with Sir Alexander Little, Director General of the British Post Office, who also was in London.



ork Times.

THE WEATHER

Fair and slightly warmer today; tomorrow possibly rain or snow.

JANUARY 8, 1927.

TWO CENTS

NEW YORK AND LONDON TALK FREELY, OPENING NEW RADIOPHONE SERVICE; FIRST PRIVATE CALL TO NEW YORK TIMES

LONDON HAILS NEW TIE

Radiophone Is Seen as Equal in Importance to Opening of Cable.

SERVICE IN GREAT DEMAND

Business Houses Are Among the First to Take Advantage of Quick Intercourse With Us

SIMPLICITY STIRS WONDER

31 CALLS ARE MADE IN D

Static Troubles Use Slightly, but Voic Usually Are Disti

TIME EXTENDED TO 6:

Sir Evelyn Murray and W. S. Gifford Call Phone New Link Between Nations.

SOCIAL AND BUSINESS CALL

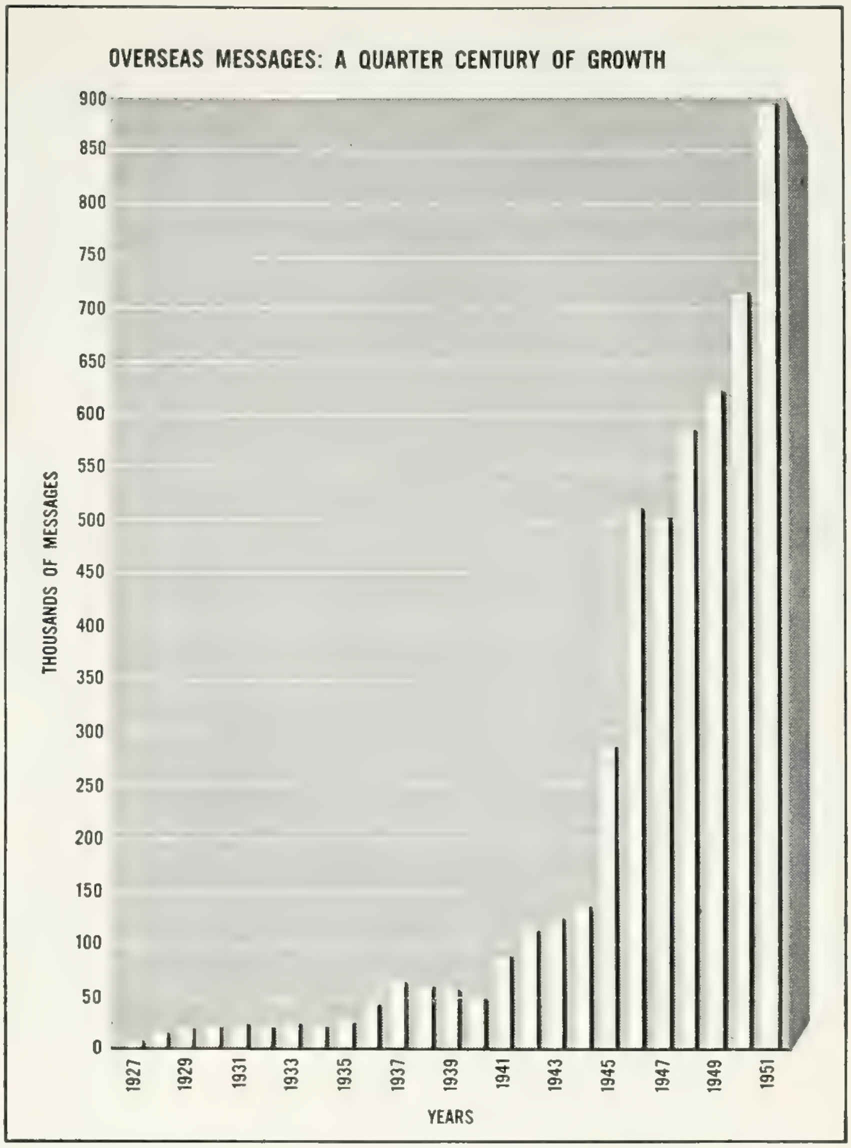
Two Advertisements Also Cro Ocean to The Times—Se Continues at 8 30 A

$6,000,000 IN DEALS OVER RADIO

WALKER

The opening of overseas service was a noteworthy event of twenty-five years ago

After confessing that he had found his original conversation in 1927 very exciting, Mr. Gifford stated that he was now impressed by "the realization that this service has become a regular, every-day part of life for so many people all over the world. Overseas telephony has gone farther and faster than we could have hoped a quarter of a century ago.” All participants in the occasion stressed the value to the world of what Sir Alexander called “a world-wide network linking the continents with one another and the remoter parts of the world.”



In the past quarter century the number of overseas telephone messages has multiplied to almost 900,000 a year, and the one country within reach, Great Britain, has become ninety countries and territories

The War Years

When the first decade of overseas service closed the era of pioneering in radiotelephony, 65 countries had been linked by voice. Soon, however, the rate of expansion was slowed by war. Some new countries, principally in South America, were added to the network during the war years, and the volume of business to such countries increased very rapidly. But to the countries at war and to those affected by their nearness to hostilities, development halted, and the use of the service was generally restricted to purposes associated with the conflict.

Spectacular use of the overseas service was made by the leaders of the allied countries during World War II. The Army Signal Corps employed the facilities and personnel in providing backbone Army communication systems with war theatres abroad. Another important contribution of the overseas service in this period was the “three-minute furloughs” which it enabled lonely service men and women, far from home, to enjoy with their families. From military posts throughout the world came testimony to the splendid morale value of such conversations.

Post-War Development

The first post-war years, 1946 and 1947, were devoted to the restoration of service to those countries where the war had interrupted it.

London was the first foreign metropolis to be brought within reach of the Bell System's overseas telephone service

This was delicate and difficult work in lands where telephone equipment had been ruined, experienced personnel had been dispersed, materials and money were scarce, and major political changes were being made.

In 1947, earlier plans to expand the network of circuits and to secure better and speedier service for the customer were revived. Even before the war, it had been realized that good service required direct circuits to many additional countries, particularly those offering large volumes of traffic. The first step in this program had taken place in December, 1936, when Paris and New York were interconnected directly, the original routing via London being retained only as an alternative.

In the post-war years, the number of direct routes has been so increased that today almost two-thirds of the countries and territories reached by overseas service are linked directly to the United States. In addition to the establishment of new direct circuits, there has also been a large increase in the number of circuits on those routes where demand is heavy. There are now twelve circuits to Great Britain, ten to Hawaii, eight each to France, Germany, and Japan, and five each to Puerto Rico and Switzerland.

Today, overseas messages number

almost sixteen times as many as before the war. The volume for 1951 was 25 percent above the level of the previous year.

As additional countries and islands have been connected with the United States year by year, the number of telephones it is possible to reach has mounted until 96 percent of all those in the world may now be interconnected.

We also expect to add Turkey to the service shortly, and to improve the connection with Finland before the opening of the Olympic Games in Helsinki this coming July. Finland, which is now reached by means of a switched connection in Sweden, will be served by a direct circuit from New York.

The distances spanned by overseas telephony are vast. The path from New York to Buenos Aires, for example, stretches 5,300 miles, while that from San Francisco to Sydney, Australia, extends 7,400 miles. The total mileage in an overseas connection is often much greater than the overseas link alone, because the voice may be carried over long distances by land lines at either end of the transoceanic circuit. For instance, a call from the United States to Bombay, which is reached by connecting two radiotelephone channels at London, goes 8,000 miles eastward from New York, but if the calling party is in San Francisco, 3,000 more miles have to be added to the circuit.

Improved Methods of Operation

BECAUSE of factors which are peculiar to overseas operation, it is difficult to have service always as speedy, reliable, and easy to use as our own domestic long distance service.

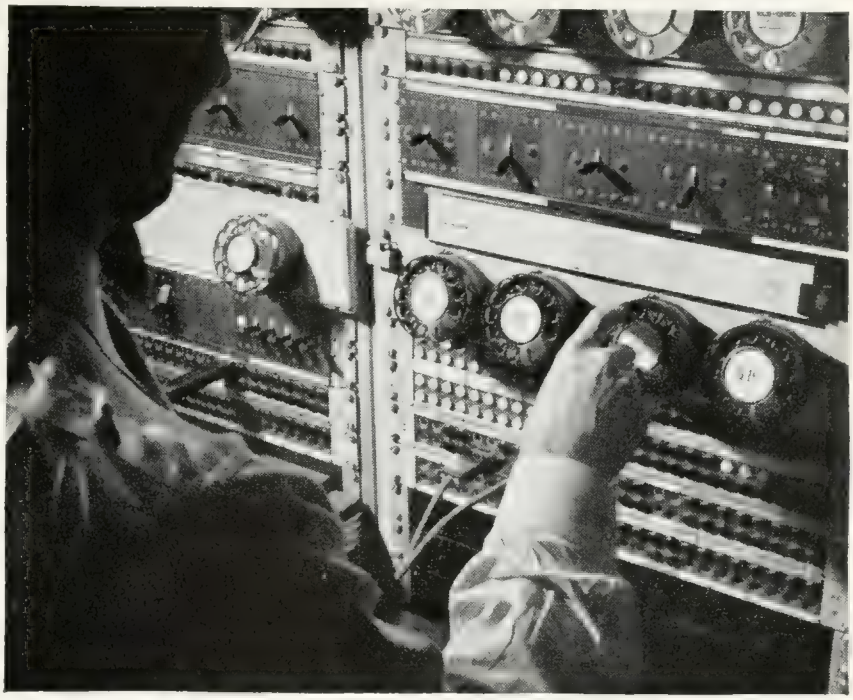
This is part of one side of the overseas operating room in New York City

Although English is used by the operators here and abroad in establishing connections on the overseas links, language differences among customers naturally introduce some difficulties. Also, there are large time differences in most cases: to the caller it may be noon, to the person at the far end of the line it may be evening or even another day of the week. Moreover, the opposite ends of each circuit are operated by separate organizations which must join forces—often with some variance in their accustomed methods—in creating an overseas service satisfactory to their respective customers. And, finally, radiotelephone circuits are subject to atmospheric difficulties—static, noise, fading—which do not seriously affect domestic circuits.

In spite of these operational problems, overseas calls now are established in about 15 minutes on the average, and for those between San Francisco and Honolulu a speed of about five minutes has been attained. These speeds represent great improvement since the war.

A major factor in this improvement has been the adoption of a simplified operating procedure, which is patterned on domestic methods. The originating overseas operator now makes the first attempt to complete the connection while holding the calling customer on the line. Previously, the operator had simply ob-

In the New York control room for overseas telephone service tained the calling information and then released the customer. This information was passed to the distant overseas operator, who got the called customer on the line, after which the connection was reestablished to the person placing the call.



A technical operator working on ship-to-shore service dials for a connection to be established with a liner at sea

Other developments which have greatly improved the quality of the service are the automatic control devices which strengthen the volume of weak voices before sending them on their long journey across the ocean and reduce the volume of very strong voices so they will not overload and cause distortion in amplifying equipment.

Economy in the Use of Frequencies

As THE DEMAND for overseas service has increased in recent years, a continuing problem has been the provision of radio frequency highways necessary to care for new routes and for added circuits on existing routes. Development of the greatest possible number of circuits on each of the limited number of radio frequency highways which can be made available to international radiotelephony has been an important factor in meeting this problem. This has required great skill and ingenuity on the part of the engineers who have the task of finding a sufficient number of celestial rights-of-way to handle the fast-growing traffic volume.

The earlier radiotelephone circuits used a 10-kilocycle band, which was the unit into which the radio frequency spectrum was ordinarily divided to obtain a single voice communication path. By making use of transmission techniques borrowed from land-line telephony, a means was later devised for sending two conversations simultaneously over each 10-kilocycle path.

Then the engineers went a step further. With the aid of supplemental equipment on each radio system, they provided a third conversational path within each radio frequency allotment. Nor has this process stopped. They have found that by widening the frequency band only enough to include 12 rather than 10 kilocycles, a fourth speech channel can be accommodated.

Economy in the use of frequencies is taking still another form. Changes in atmospheric conditions over each 24 hours make it generally necessary to assign a complement of four or more frequencies to the longer circuits, changing from one to another to secure, at a particular time, a single transmission path which is constantly clear and reliable. By sharing these assignments between two radio systems operated in widely separated directions, it is possible to move traffic over a pair of them and yet employ only about five frequencies instead of a total of eight. This is partly because antennas are used which sharply focus the transmitted radio signals, thus permitting simultaneous use of the same frequency on different routes. Again, it is sometimes possible to employ on another route one of a complement of frequencies which is not usable at a particular time on the route to which it is normally assigned.

With the help of all these techniques, derived from years of operational experience and close study of the nature of radio waves, daily operation of the approximately 130 circuits in the overseas service now employs only about 40 percent of the frequencies that would have been required with pre-war techniques. However, as the users of the service are constantly demanding more, radiotelephone engineers realize that perhaps their greatest task in the years ahead will be the provision of enough radio frequency paths to make possible adequate service. They not only will have to continue their search for methods which will provide more circuits from the frequencies assigned, but they will be forced to seek more frequency assignments.

Hawaii was brought within voice range on December 23, 1931

Service with Japan, re-established after the war, now leads in number of overseas messages

Service to Ships on the High Seas

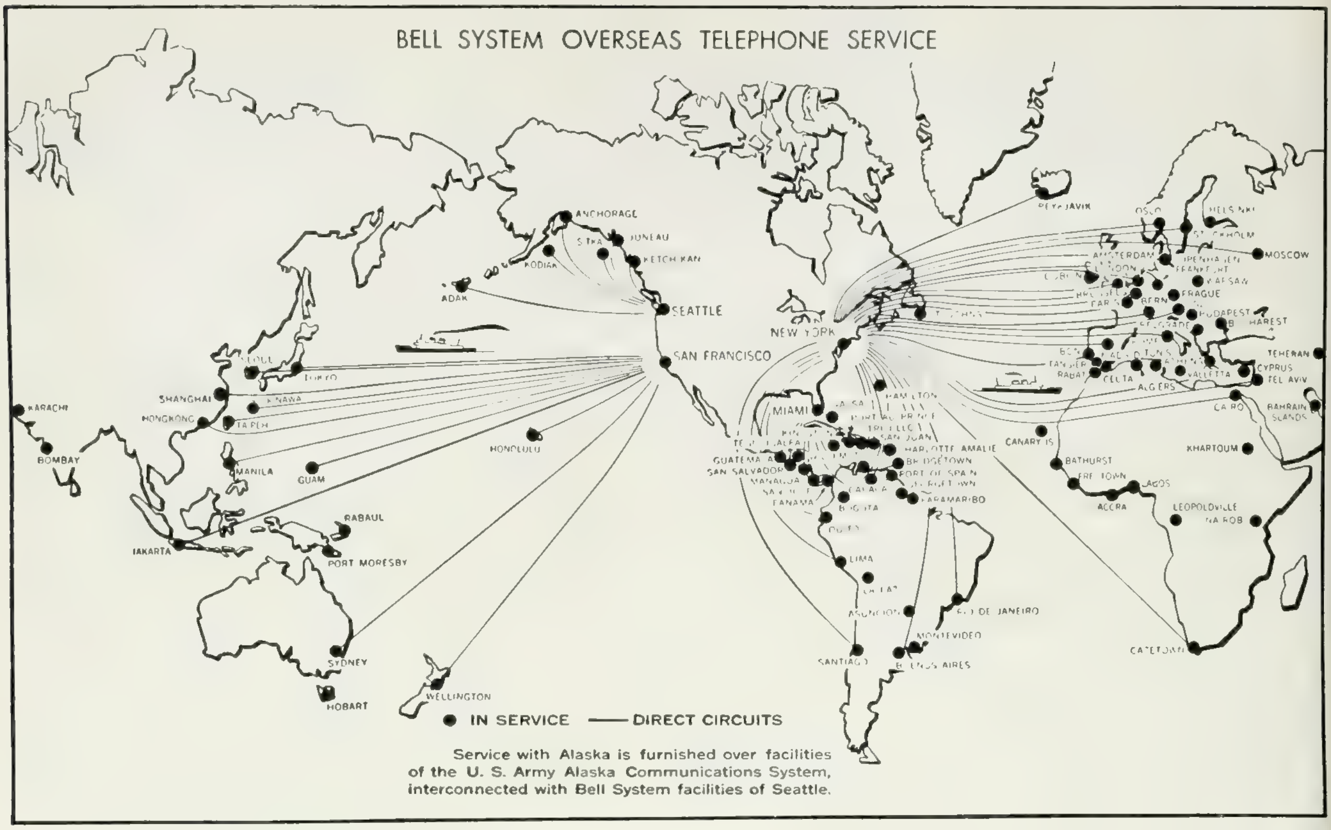
A very interesting feature of the overseas service is that furnished to ships on the high seas. This was inaugurated with the United States liner "Leviathan" in 1929. It has subsequently grown to the point that there sometimes are as many as 100 vessels on the high seas which have contact with our shore stations. However, the 20-odd passenger liners plying the trans-Atlantic lanes provide the bulk of this telephone traffic.

Depending upon their locations, these vessels may establish connections with the United States through New York, Miami, or San Francisco. During the past year over 20,000 conversations were carried on between customers in the United States and others aboard ships on the high seas.

The operation of service to ships at sea is similar to that to distant lands. However, it has the added complication of a moving distant terminal. This requires that the route and progress of the ships be known at all times, so that when it is necessary to reach a particular one, the frequencies and circuits most suitable to that ship's location can be used.

Reduced Rates

When overseas service was opened, a three-minute call between



Service with Alaska is furnished over facilities of the U. S. Army Alaska Communications System, interconnected with Bell System facilities of Seattle.

New York and London cost $75. Early in 1928, this rate was lowered to $45, the first of many reductions made possible by increased use of the service and economies from a multitude of improvements introduced in the past quarter century.

Today, the week-day rate for a 3-minute message from anywhere in the United States to most overseas points is $12.00. Rates as low as $4.50 apply to some of the shorter routes, and as much as $15.00 is paid for conversations to a few of the more distant places reached by switched connections. On many routes, reduced night and Sunday rates are in effect.

About 60 percent of the total volume of overseas traffic involves points along the northeastern seaboard of the United States. New York State customers are the leading users of the service, and account for about 40 percent of all the messages handled. California users are second in number, with 15 percent of the total traffic.

About 40 percent of the traffic is with Europe, 30 percent with Pacific Countries, and 25 percent with Pan-America. The countries with which we have the most calls are Japan, Hawaii, and Great Britain.

Overseas Partners

Long Lines has some 65 partners in all parts of the world who join in furnishing the overseas service. To ensure smooth functioning and to meet day to day problems, it is necessary to keep closely in touch with the operating staffs of all these telephone organizations.

There is, in addition, the task of deciding upon general policies for long-range growth and of developing plans to implement them. This entails considerable correspondence with the distant partners about results, methods, rates, accounting practices—on every matter which goes to make up the fabric of good service. An example of one of the perplexities incident to such a far-flung service, and which presents special difficulties in unsettled times, is the different monetary units in various countries and the changing values of national currencies.

Future Development

In the first twenty-five years of overseas telephony, service has been established to most existing countries of the world, and it is apparent that expansion in that direction is limited. On the other hand, there is still a large field for further improving the reliability, continuity, and capacity of a service with such a fast-growing body of users.

Aside from the problem of securing sufficient frequencies for transmission paths, perhaps the greatest challenge to good overseas service by radiotelephony is the effect of adverse atmospheric conditions. This is a situation which is met time and again on long-haul radiotelephone circuits, particularly over the North Atlantic path, which is especially subject to magnetic storms affecting high-frequency radio transmission.

To avoid the Northern paths, on which such effects are most devastating to stability, plans are under way to establish additional secondary routes for use when the principal circuit to a point cannot be used because of atmospheric disturbances. At present, one such alternative route is set up on an experimental basis by way of Paramaribo on the northern coast of South America, as a secondary link between New York and Amsterdam, and the possibility of other alternative routes by way of relay points in both the eastern and western hemispheres is now being explored.

As the first quarter century of overseas service closes, it is interesting to realize that the service, which started as a special form of telephony, has come more and more to resemble regular long distance communication. That the public, which originally thought of overseas calls in terms of stunts or emergencies, has sensed this change is clear from its growing reliance on the service.

Here is a tool of increasing importance to finance, industry, and commerce . . . a voice channel for government and the armed forces . . . a means of broadcasting spot news from abroad . . . an invaluable intercontinental speech path. And that is how those responsible for the service want it to be regarded—as a ready aid when personal or business matters require a telephone call to points beyond the seas. In the past twenty-five years long strides have been made toward this goal, and in the future this global service will be made still more convenient and effective.

A Great National Resource

From the A. T. & T. Annual Report for 1951

Six years of post-war telephone progress have brought outstanding results. Together the Bell System and the Independent telephone companies of the United States now serve more than 45 million telephones all over the nation. This fast, convenient, reliable service is by far the best and most extensive telephone service in the world. No other country has such a resource.

This has not just happened.

Good telephone service depends on able people of good spirit. The men and women of the Bell System are competent, courteous, and devoted to their work. They are well trained. They have opportunity to get ahead. They also have competition, for promotions are made from the ranks on the basis of ability.

Good telephone service depends on sound organization. The Bell System is well organized for its task. Responsibility and authority are decentralized. At the same time, service to the public is unified. Operating, research, and manufacturing groups, working closely together, are dedicated to the common purpose of rendering the best possible service to the public at the lowest possible cost.

Good telephone service requires constant effort to improve methods and provide the best in equipment. Bell System research is continually opening up new frontiers. Equipment produced by the System's own manufacturing organization, the Western Electric Company, is of the highest quality and is supplied at prices that help to keep the cost of service low.

Good telephone service depends on the continuing full confidence of many hundreds of thousands of people to whom we look for capital. The Bell System is financially sound. Under regulation, it has been free through the years to earn enough to pay good wages, pursue effective research, reward ability, and keep faith with all who have put their savings into the business.

Finally, good telephone service is the result of a way of life—a tradition and policy of trying always for the best, a personal sense of responsibility, and the determination to meet individual and national needs no matter what the obstacles.

Results in 1951 bear witness to the effectiveness of these principles in action. The Bell System can be relied on to serve the nation well.

In This Rapidly Moving World, Opportunities to Expand The Usefulness of Our Services Never Seemed Better Than They Do Right Now

The Telephone Looks To the Future

George L. Best

In the relatively short time since World War II, the telephone business has been going through the most spectacular period of expansion in its history. Within the past decade the Bell System has grown more than it had over the entire previous sixty-five years, and the pace is still rapid.

It isn't necessary to recount here the hundreds of new central offices, the thousands of miles of new cables, the millions of telephones, and the billions of dollars of added capital investment which have gone into the Bell System in the past few years. These are well known.

What seems important is to pause now long enough to ask ourselves what has been responsible for this growth, where we are heading in the future, and what added responsibilities and opportunities this tremendous expansion is bringing us. That the future will be full of problems we can be sure. That it will be full of opportunity and great challenge is equally certain.

Since the present period is simply one phase of the longer history of our business, we can probably get a better perspective of what is happening today if we view it as simply one chapter in our progress. And what is happening in our business, of course, is only one phase—an extremely important one—of the social and economic progress of the country as a whole.

As a background, then, for understanding the recent past, and so preparing in a measure for the years to come, let us return briefly to the days before the telephone—to the time when, if a man wanted his words understood farther than he could shout, he had to go or send. That is only seventy-five years ago.

Before the Telephone

At the time of Bell's invention, only seven years had elapsed since the golden spike was driven in Utah, signalizing the completion of the first transcontinental railroad line, and a large part of the great era of railroad building still lay ahead.

While there had been in this country a steady movement westward from earliest times, nearly half the people still lived in the states along the Atlantic Coast, and four-fifths of the population was located east of the Mississippi.

The river steamer and canal boat still handled a large part of the long distance transportation of people and goods. Outside of towns, roads were bad or non-existent. The earliest automobiles were two decades off, and airplanes were only a dream in the minds of a few visionaries.

Communication near by was generally by personal visit or messenger; and to places farther away it was by letter or, on matters of greater urgency, by telegraph.

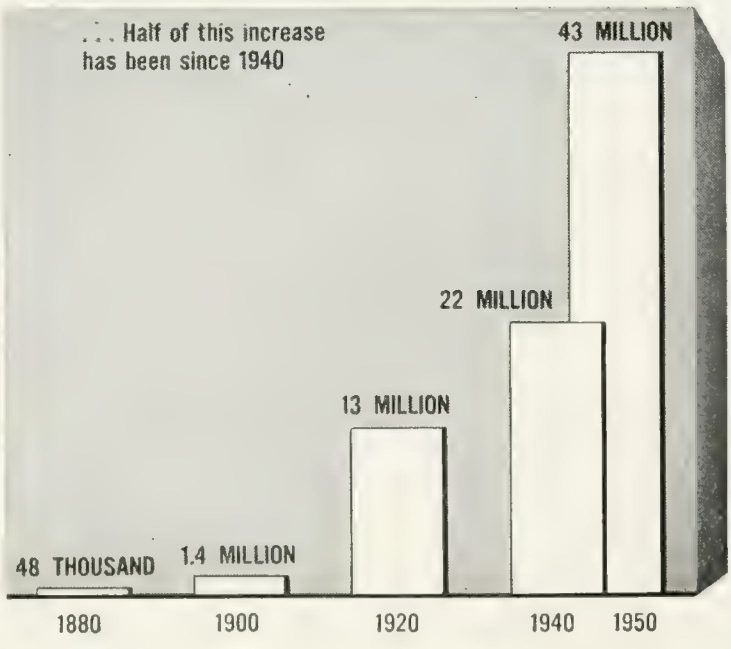
We were then largely a rural people. About three-fourths of the country's inhabitants lived on farms or in villages and very small towns.

The incandescent electric light had not yet made its appearance, and lighting was usually by oil lamps, except for some larger communities where illuminating gas was available. Heating and cooking were mostly by wood or coal, and the fireplace often did both. Housewives, almost without exception, baked their own bread and many churned their own butter. Fruits and vegetables "in season" came from their own gardens or from nearby farms, and at other times were the product of their own preserving and canning.

In most communities, the only place to shop was at the general store. The larger places boasted such specialized establishments as grocery, drygoods, and hardware stores; but even there the customer found little choice in styles and grades of goods.

Most manufacturing was carried out on a small scale, in local shops and plants which got much of their materials and supplies from nearby areas. In many factories, hand tools and labor were still an important part of production. People

SINCE BELL'S TIME U. S. TELEPHONES HAVE GROWN FROM A FEW THOUSAND TO MORE THAN 43 MILLION . . .



themselves, with the aid of the local blacksmith, could usually repair the normally simple machinery when it broke down.

There was nothing corresponding to our present-day radio, movies, and television. To the extent they could, people created their own forms of entertainment. They had not much time to devote to recreation, however, because adults and children alike were busy most of the time at their work and doing the necessary chores.

Picture, then, a society in which people lived and worked in more or less self-contained communities—and within those areas were largely dependent on their own efforts.

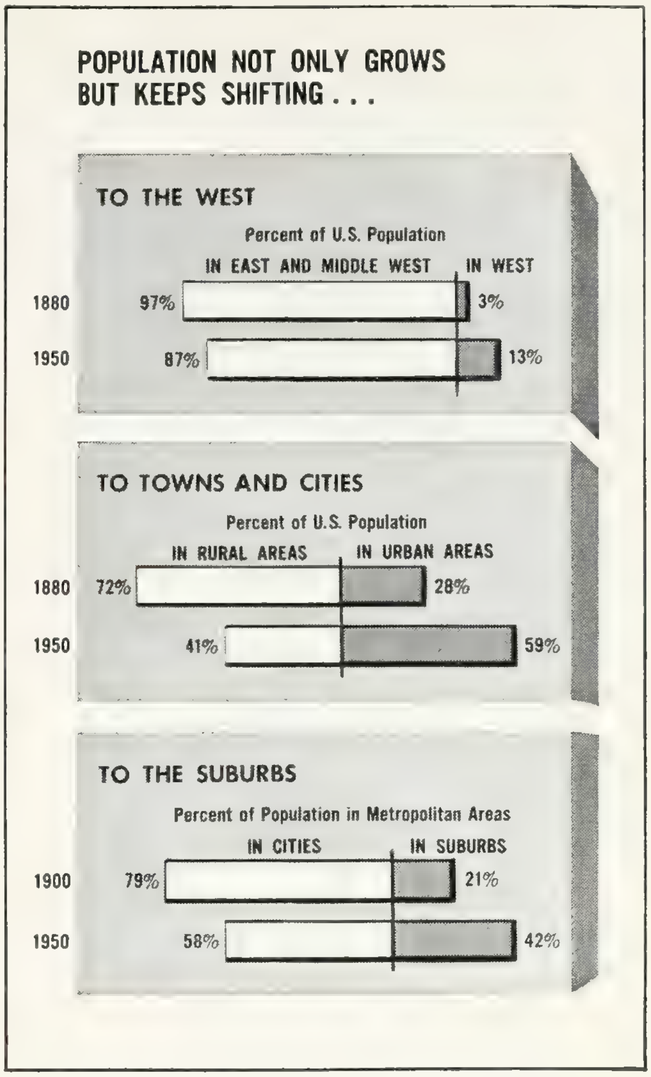
Picture, too, a pattern of home and business life in which there was little need to travel extensively, or to communicate except occasionally beyond a very limited area. And with long hours of work there was little time to devote to social contacts and recreation.

This, in brief, was the life our grandparents knew in the United States three-quarters of a century ago.

The Transition

THE CHANGE which has taken place within the memory of many now living is astounding.

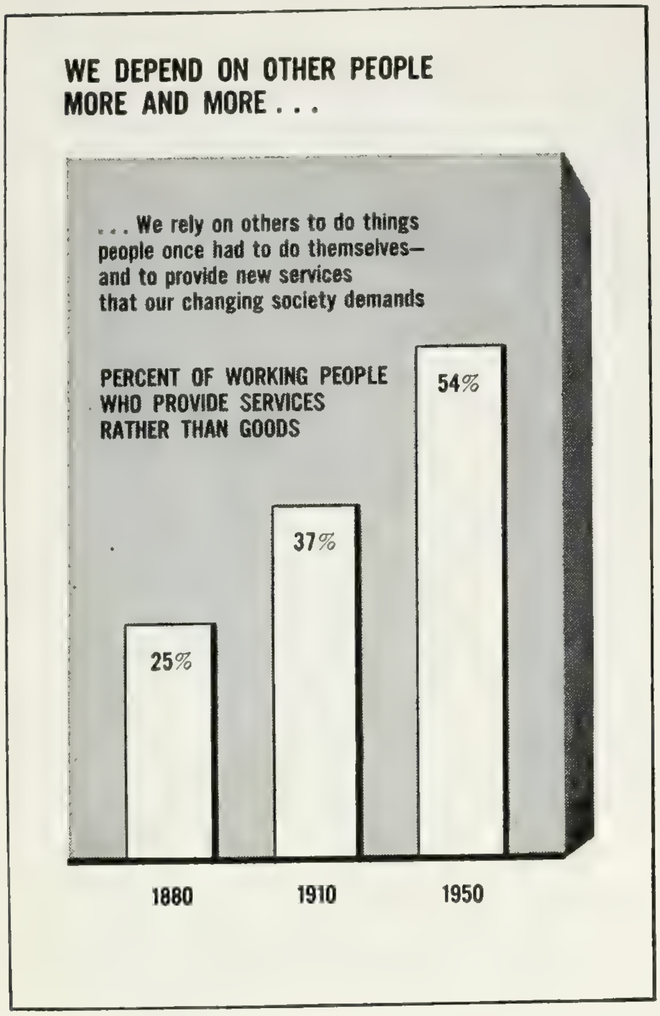
Our economy is no longer predominantly agricultural but has become increasingly industrial. The proportion of people who live in urban and suburban comunities has risen from a scant 25 per cent in Bell's youth to over 60 per cent today. During the same period there has been a great growth and fanning out of population over the entire nation.



POPULATION NOT ONLY GROWS BUT KEEPS SHIFTING . . .

Beyond this, so greatly have our methods of production—both agricultural and industrial—improved, that a larger and larger proportion of our people can now devote their energies to providing a wide range of services. These include utility services of all types, increased facilities for education, new and expanded facilities for health and recreation, and a myriad of others which aid us in our homes and in our jobs.

In the home there is far less drudgery. True, we do not have the help of anywhere near as many domestic servants as before. However, there is not the same need for them—for there is a convenient ap-



WE DEPEND ON OTHER PEOPLE MORE AND MORE . . .

pliance for doing almost everything, and the goods available in the modern store have enormously simplified the job of the housewife.

Add to this a telephone that brings members of the family speedily within speaking distance of practically everyone, an automobile, an oil or gas burner, a radio, and a television set, and you come up with a way of life such as our grandparents would never have dreamed of.

The change which has taken place in the conduct of business is no less spectacular. Business operations have become vastly more far-flung and specialized, and markets for goods have become literally nationwide. Factories can now obtain machinery and supplies and can subcontract work from one end of the country to the other, and can do these things with less time and effort than it used to require to do business with people nearby.

The Significance

PERHAPS the most basic social and economic change in all this—certainly the most evident one—is the far greater dependence we now have on other people.

In the home, the new aids available to the housewife have naturally encouraged her to abandon former skills in the kitchen and elsewhere around the house. Father no longer attempts to repair the sort of things he once did or to undertake the many odd jobs he used to be called on to perform.

Businesses, too, would have to do some pretty radical readjusting to carry on without the constant flow of help they get from other industries, oftentimes far distant. Specialists are our main reliance today.

All of the new things at our disposal have contributed to a more efficient and pleasanter way of life. They have given us more opportunity to broaden our social contacts, both in number of acquaintances and in the distances over which they are scattered. But, inevitably, they have made us rely increasingly on assistance from others.

Clearly, the telephone is contributing in a very significant way to this important social and economic change. In fact, it would be hard to visualize without the telephone many of the things which we accept as commonplace today. The tempo and widespread nature of business operations depend heavily on it. Similarly, home life would be quite different for most people without the aid it provides. And the telephone is playing an increasingly vital role in both military and civil defense.

To sum it up, we could not possibly depend on others, as we now do in our daily lives and actions, if we could not surely and quickly reach those on whom we rely, when we need them. The telephone enables us to do this.

The other face of the coin is that the great extension of business and social interests which have come with the development of our present way of life has had a pronounced influence on the use of both toll and local telephone service. This is the reason the Bell System has grown.

The Recent Past

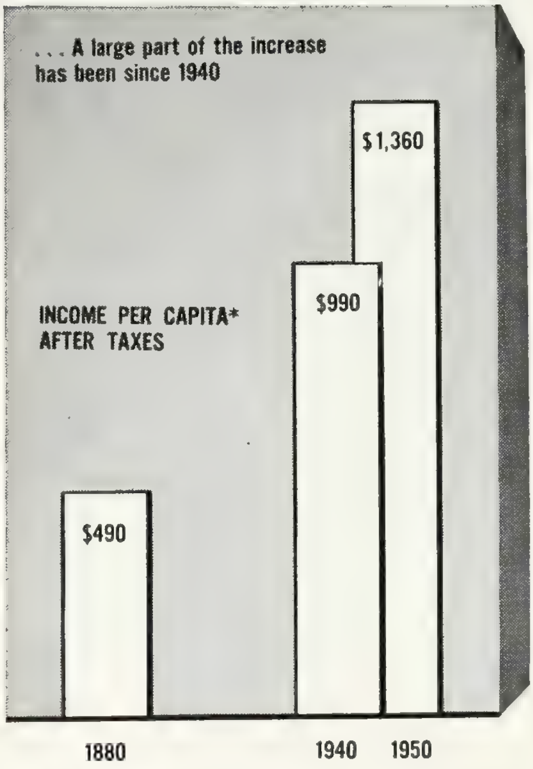
With this as a long-term background, let us now look a little more closely at the rapid changes which have taken place in recent years.

It is apparent that most of the causes of the great expansion in telephone service which we are experiencing are not basically new. The same broad influences we have seen since the beginning of the business have continued to affect us over the more recent past.

In addition, some new factors have entered the picture to give an extra spurt to the growing importance of telephone service in our lives.

For one thing, there has been a remarkable upsurge in population growth. In the 1940s, the increase was numerically the greatest in the country's history. It reflected a sharp rise in the birth rate from the low levels of the depression years, along with a continuation of the long downward trend of death rates.

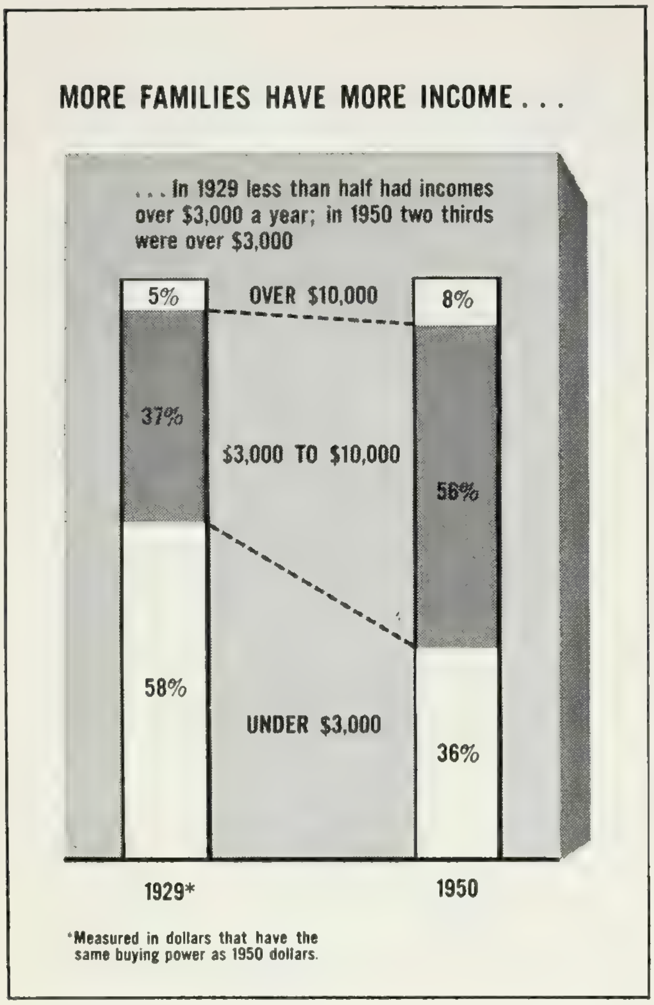
PEOPLE HAVE ALMOST THREE TIMES AS MUCH MONEY TO SPEND . . .



*1880 and 1940 measured in dollars that have the same buying power as 1950 dollars

Another important element is the change which has taken place in the last decade or so in the level and distribution of income. Not only has the total income of the people risen at a much more rapid pace than ever before—even after allowing for the rise in prices—but a much greater part of the increase has gone to people in the lower income brackets. The effect, naturally, is that more people are able to have more of the things that add to the comforts and enjoyments of living.

What is more, in this period of rising prices the rates for telephone service have not gone up nearly as much as the prices of most other things. Consequently, telephone


MORE FAMILIES HAVE MORE INCOME . . .

. . . in 1929 less than half had incomes over $3,000 a year; in 1950 two thirds were over $3,000

*Measured in dollars that have the same buying power as 1950 dollars.

service is relatively more of a bargain than ever.

And last but by no means least is the accelerating rate of what, for want of a better term, we call the "telephone habit." This has been a growing force from the beginning of the business. But to cite just one example, the amount of time the younger generation spends at the telephone doing homework and conducting social affairs will tell us that something new and powerful has been added that did not exist when most of the readers of this MAGAZINE were teen-agers or younger.

These are the things which have combined to give us the current upsurge we have been and are experiencing in telephone growth.

The Setting for Tomorrow

WITH such a picture of past and present, the outlook for this business never seemed more promising.

We should not lack potential customers. Continued rapid growth in population, at least for some years, appears to be a reasonable expectation. There should be more homes, then, for this reason as well as to ease the war-time housing shortages which have never been fully relieved. Continued improvement in health and medical knowledge will mean that more people will live longer; and extension of pensions and broadening of Social Security coverage will mean that more elderly people will be able to maintain homes of their own.

The spreading out of population toward less developed areas of the country and the movement to the suburbs bid fair to continue. Decentralization of industries goes on apace.

As a nation, we are greatly expanding our productive capacity—particularly at this moment under the pressure of defense preparations. This, and our never-ceasing American urge to find better ways of doing things, should mean continued progress over the long run toward higher levels of national income, greater purchasing power of the people, and rising standards of living—(even granted that for one reason or another there may be temporary setbacks).

In addition to these, there is no sign of any let-up in the two important social and economic influences on our business which have already been

The future holds great opportunities for expanding the usefulness of telephone service cited. Our dependence on other people in our day-to-day living is still growing rapidly. The acceptance of the telephone not as a luxury but as an essential element in American life—the "telephone habit"—is also growing. The result is surely a firm structure of continuing and growing demand for the services which we furnish.

Opportunity—and Challenge

THE FACT that people have become more and more dependent on the telephone imposes on all of us engaged in the telephone business an increased responsibility to see that the service we provide is in every way the best of which the art is capable.

Some of our obligations in this respect are fairly obvious. Greater speed, greater reliability, greater economy are objectives to which telephone people have long been geared. The future holds ample opportunity to make even further progress along this well-trodden path.

Dialing of toll calls by operators was introduced only a few years ago, but well over a third of all toll board calls are now operator dialed. And just a few months ago nation-wide dialing by customers reached the stage of the trial it is now receiving in Englewood, New Jersey.

Developments such as these are the best evidence that progress toward the familiar goals continues and will continue to be rapid. Sometimes the process unfolds in ways which the customer can recognize, yet often too as improvements of which the telephone user is scarcely aware but of which he is the beneficiary.

There has always been more to it, however. Service in each era must be adapted to the needs of that era, which may be quite different from those in the past.

The early-day telephone was screwed to the wall, and the marvel of talking by wire at all was so great that nobody thought it a hardship to have to stand up to do so. However, as more people learned to use it, and found that it could serve different needs, it became apparent that this new method of communicating must be made more convenient if its full benefits were to be realized. Thus we moved along to the upright desk stand and then to the greater ease of the hand set.

The same pattern has been repeated over and over, as people's needs changed and were recognized: Wiring plans and key sets, to permit more efficient and more convenient use of customers' lines and telephones. Dial PBXs, to speed the calls of people in large or medium-sized establishments. Order-receiving equipment, to improve the efficiency of department stores and large service organizations. Telephone service to countries overseas, to ships, to motor vehicles, to trains. Networks for the transmission of radio and television programs. The list is indeed a long one.

It would be strange if the very influences which lie at the roots of our recent tremendous growth had not brought about material changes in the communication problems of at least some of our customers. It is an important part of our task to find out what changes have occurred in their needs and what we have to do to help fill them. Ours is the responsibility to discover the new ways in which better, broader, and more convenient communication service can help them in their lives and in their work. Ours is the need for foresight and for bold imagination.

Assurance for the Future

THE most fascinating thing about the telephone business is that new and unexplored opportunities for service are continuously opening before us. That is as true now as at any time in the past—perhaps even more so.

The storehouse of ideas and discoveries which will ultimately find their way into better and broader telephone service is being expanded continually. Only those who are deeply immersed in the technical processes of research and development could hazard a guess as to how rapidly this new knowledge can be put to practical use.

There is no doubt whatever that the well tested teamwork of the operating, research and development, and manufacturing branches of the Bell System organization will continue, as in the past, to bring about continuous and rapid progress in the art. And our understanding of what the customer wants or needs must fully match our technical ability to find ways of filling those requirements.

Each major accomplishment simply opens up ways of making telephone service still more valuable by further effort. To be members of a team that has the opportunity to contribute so much to the material welfare of the nation is both an inspiration and a challenge to all of us in the telephone business.

Who's Who & What's What

(*Continued from page 3*)

foreign telephone administrations in connection with the A. T. & T. bulletin "Telephone Statistics of the World" is written in languages other than English, and ELIZABETH WRENSHALL finds her facility with foreign languages useful in gathering and compiling the data which she uses in her daily work in the Chief Statistician's Division of the Comptroller's Department. After making translations for the censorship authorities during World War II, Miss Wrenshall joined the A. T. & T. Company in 1945. This is her third contribution to this MAGAZINE, her most recent previous one being "Where the World's Telephones Are," in the issue for Winter '50–51.

Index Now Available

AN INDEX to Volume XXX (1951) of the BELL TELEPHONE MAGAZINE may be obtained without charge upon request to the Public Relations Department, American Telephone and Telegraph Company, 195 Broadway, New York 7, N. Y.

The "Dallas Philosophy" of 1927 Is Still Exemplified in An Attitude toward the Operation of This Business Which Enables Telephone People to Do Their Best

Long-Range Business Policies
A Case Study

Keith S. McHugh

There follows the text of an address given by the President of the New York Telephone Company before a meeting of the American Management Association in Los Angeles on January 16, 1952. Active in the Association since 1936, Mr. McHugh is at present a director and a member of its executive committee. EDITOR

ALL CORPORATE BUSINESSES begin with a charter or license of some sort granted by the sovereign state. These charters are given on the assumption that authorizing people to do business in the corporate form is for the public benefit. Even though the chartering is done on a more or less automatic basis, the implication still is that it is to the public's interest to have such organizations and that their many owners and employees serve the public's needs.

The companies which seek and obtain these charters, therefore, actually accept a responsibility to serve the public. The details of this responsibility are not very clearly stated by either the corporation or the state. The assumption is that if the company works within the laws, it should benefit the public.

However, the general public quite often is critical of corporate activity. Sometimes the ordinary human suspicion of size alone creates criticism. The laws governing business have been changed from time to time because of public criticism, and they can be changed at any time. There are few if any inalienable rights that business has if the public is of a contrary opinion.

IN RECENT YEARS, much of the attack on business has been focussed on profits. Profits are alleged to be excessive. Some of this criticism is sincere, some is deliberately misleading. Lately, business men and some others have done much to explain the true function of profits, and effective educational work is continuing in many areas.

But not all the public has yet been convinced of the constructive business and social policies that have guided the managements of thousands of successful companies, large and small. I believe that an important reason for this is that management has failed to state its own long-range policies clearly and emphatically.

Perhaps, therefore, a clear statement of the policy which a corporation intends to follow in carrying out its responsibilities to the public might be useful.

I should like to suggest this possibility to you in management.

My suggestion is not based on theory but on experience, for I have worked under such a stated policy in the Bell System for many years. The Bell System is a regulated industry, and I fully appreciate that its experience may not be directly applicable to the general field of business.

But my impression is that operating under a stated policy might be as useful to general business as it has been to us in a regulated business. Such statements would naturally differ according to different conditions and also according to the conceptions of different managements.

As I said, my belief that the formulation and statement of a policy might be advantageous to all business comes from my own experience. With your forbearance, I should like to tell you what that experience has been.

The Only Sound Policy

I AM SPEAKING here tonight as an operating telephone man with one of the units of the Bell System—but not for or on behalf of the American Telephone and Telegraph Company, our parent company. The case history is the development and consequences of a publicly stated long-range policy to an operating telephone member of the Bell System team.

The early days of the telephone business were intensely competitive. There were two companies in most towns. The results were chaotic, and neither the companies nor the customers were happy. The people solved the problem by legislation permitting acquisitions and mergers, with broad regulation of service and rates of the remaining single company.

There emerged the Bell System, with eighteen operating units now serving thirty-seven and a half million telephones, of which the Pacific Telephone and Telegraph Company is among the largest; and an independent telephone industry of some 5,500 companies, serving around eight million telephones. Each of these units—Bell and independent—operates exclusively within its own territory. Regulation is by state authority as to intrastate business and by the Federal Communications Commission as to interstate business.

By 1927, public regulation of the telephone business had existed for approximately twenty years. Bell System Companies for many years had been evolving certain internal policies as to quality of service, rates, and relations with the public. No one man was responsible for these principles, although some had more to do with them than others. They came, rather, from the combined experience, the hopes and aspirations, of the management throughout the System.

It seemed wise and timely to the then young president of the A. T. & T. Company, Walter S. Gifford, to state publicly the principles that guided the management. The occasion was the annual meeting in 1927 at Dallas, Texas, of the National Association of Railroad and Utilities Commissioners, an organization which includes all the State and Federal regulatory Commissions.

After reminding the assembled commissioners that they and the managers of the Bell System Companies were engaged in a common enterprise and that success in that enterprise depended upon mutual confidence and understanding, he said that he wished to state very briefly the principles that guide the management of the Bell System. These words were included:

"*. . . Obviously, the only sound policy that will meet these obligations* [*he had been speaking of obligations to investors in the telephone business and to the customers*] *is to continue to furnish the best possible telephone service at the lowest cost consistent with financial safety. This policy is bound to succeed in the long run and there is no justification for acting otherwise than for the long run.*"

A little later in the same talk he repeated the commitment in slightly different words:

"*Our policy and purpose are the same as yours—the most telephone service and the best, at the least cost to the public.*"

This was an unusual speech at the time, but its significance was largely missed by the press and the public. It was unusual because it was one of the few instances of which I know where a business has publicly stated the basis on which it intended to serve the public. Even the financial world, which normally is quick to grasp the policies of all large companies, missed the significance of the statement. Yet this short straight-forward statement has been the guiding principle of our company and of all Bell System Companies. It is used so often within the business that its meaning is indelibly stamped on the daily lives and conduct of all telephone men and women.

Searching for the Best

THE POLICY is so simple that some of its significance may not at once be apparent.

First, we agree to furnish "the best possible telephone service." If that means anything, it means that we must always be searching for the best plant and equipment known to man; that we must continuously prosecute research in communications and keep up with the work of all others in the field throughout the world so that we can make the best results of all technology available to the customer.

It means that we must have telephone employees—management and workers—who not only are highly skilled, well trained, and efficient, but who are well paid and happy in their surroundings and life work, since the best service cannot be given unless these things are so. This commitment, part of the whole policy, was publicly stated two years later in the annual report of the American Telephone and Telegraph Company:

"While the Bell System seeks to furnish the public the best possible service at the least cost, the policy which recognizes this obligation to the public recognizes equally its responsibilities to its employees. It is and has been the aim to pay salaries and wages in all respects adequate and just and to make sure that individual merit is discovered and recognized."

The combined broad service policy also means an obligation for constant improvement in methods of operation. It means a willingness to undertake large money risks in developing and bringing new services to the user. Over all, it means a continuous effort to see that all telephone service is given first in terms of the customer's requirements and not primarily in terms of what may appear to be the Company's interest. And finally, it has meant the development of an internal system of competition between management men and women at all levels as a safeguard against the development of complacency in a business which has no direct competition.

The other half of the policy statement, namely, to furnish the best possible telephone service "at the lowest cost consistent with financial safety," is perhaps even more striking in its long run implications. For Mr. Gifford later in the same talk said:

". . . Earnings in excess of these requirements [those necessary for financial safety] must either be spent for the enlargement and improvement of the service furnished, or the rates charged for the service must be reduced. This is fundamental in the policy of the management."

In bald terms, this is a voluntary commitment to limit profits to those required for financial safety; an undertaking that any profits beyond these will be devoted either to service improvement or to reduction in rates or both.

Four Major Consequences

THERE IS TIME HERE to enlarge briefly on only four of the major consequences flowing out of this public statement of policy.

These are: first, the implied commitment to conduct continuous research; second, the promise in terms of the quality of men and women needed to do the service job, and the personnel policies flowing from this concept; third, the system of internal competition for management which developed from the service concept; and, fourth, the implications of a publicly stated policy of restraint in profits.

Actually, a policy of continuous research and development has been in existence since the earliest days of the telephone. The telephone business as we know it today would not exist had this not been so. The early instrument of Bell was crude, and you could talk intelligibly over a pair of wires for only a very short distance. It was at once apparent that if its usefulness was to be extended to include many in the same locality, to say nothing of interconnecting cities, new and wholly unknown areas of science and engineering must be explored. Yet the early entrepreneurs who backed Alexander Graham Bell and his novel invention must have been men of great faith and vision, because in 1878, two years after the invention, Bell wrote:

"It is conceivable that cables of telephone wires could be laid underground, or suspended overhead, communicating by branch wires with private dwellings, country houses, shops, manufactories, &c., &c., uniting them through the main cable with a central office where the wire could be connected as desired, establishing direct communication between any two places in the city. Such a plan as this will, I firmly believe, be the outcome of the introduction of the telephone to the public. Not only so, but I believe in the future wires will unite the head offices of the Telephone Company in different cities, and a man in one part of the country may communicate by word of mouth with another in a different place."

TRULY THIS was vision and faith! For no one, not even Bell, could have then had the slightest idea as to how the physical objectives could be accomplished.

By the time of the general policy statement in 1927, Bell Telephone Laboratories, Inc., as we know it today, was a physical fact. It includes at present about 6,900 people, of whom 2,400 are scientists and engineers. Over the years, the Laboratories has produced a continuous flow of new and useful developments in communications and allied fields, making it possible to telephone quickly, easily, and at a modest cost from any place in America to any part of the civilized world. It has made notable contributions to science generally. It has been a vital factor in our national defense in two wars and in preparing to prevent a third.

I will touch here only briefly on the business consequences of setting up a research and development organization to make its contributions to our public policy. I believe that this research has been vital to the growth and success of our business and that it has paid for itself many times over.

When one publicly commits one's self to research and development aimed at continuously improving one's service or product, certain responsibilities flow from such a course. One is the practical commitment to keep the work going in good times and bad. It takes years to bring together a top working team of scientists and engineers and this asset of the stockholders and of the public must not be dispersed thoughtlessly when the arctic breath of bad times is felt.

There are economic and social responsibilities which flow from fruitful research. As new discoveries of merit emerge, there arises an obligation to use them within the business if they will further the service policy; and there may be some that should be made available to anyone outside the business so that all can benefit.

THREE EXAMPLES of economic problems arising from this research may be of interest: overseas telephony; teletypewriter exchange service; and the new instrumentalities, coaxial cables and radio relays, that transmit telephone calls and television from one city to the other.

The first two are commonplace, and probably every man in this room has used them at one time or another. Yet each involved large financial risks to start, running into many millions of dollars, and great faith and patience on the part of management before they were used in any substantial way. Thus overseas telephony was first introduced in 1927 and now reaches all parts of the world. At the end of three years only 16,000 calls were made per year. This month, the twenty-fifth anniversary of overseas service, we are handling calls at the rate of 900,000 per year.

Business needs beginning with World War II really made teletypewriter exchange service an important factor in communications, although it had been introduced ten years earlier. Now it has 28,000 stations, which originate 15 million messages annually.

Coaxial cables and radio relay systems are essential to obtaining economically hundreds of telephone circuits over one route and to transmitting television programs between cities. As to the television portion of these facilities, only the long range service policy and faith in the future of television has made Bell System Companies invest millions of dollars in them.

Each of these new business risks was without early prospect. Many would have said "Let some one else take the risk and develop these projects."

And then there are the problems of patents and of licensing others under one's patents which inevitably arise when one conducts fruitful research. Both the private and public aspects of this question are filled with difficulties for management.

But all told, a research and development program is a wonderful thing—in our case an essential thing if we are to fulfill our public promise.

The Essence of Performance

THE IMPLICATIONS of the service policy as to the men and women in the business might be thought of in terms of the more frequently used expressions "Labor policy," "industrial relations policy," etc. Actually I think they are much broader than these concepts, because our business is a personal service business. If telephone service, which requires direct relations with the user, is to be the "best possible," the measuring yardstick must really be with the user, not with the company. The kind of person the employee is and the attitude he has towards the customer will largely determine the user's final reaction. Superb technical service is only the start: the courtesy, the consideration for the customer's problems, the personal attitude of the employee, is the essence of performance.

There is not time to go into an extended discussion of the policies relating to telephone men and women except to point out one or two things about them which bear directly on the broad policy of the best possible telephone service. Thus we must select good people and train them well; we must give each the regard due him as an individual; each must have an equal opportunity to advance to the limit of his or her ability; we must pay good wages in comparison with other wages in each community, whether large city or small town; we must provide reasonable safeguards against accident, illness, old age, and death; and, of course, we must keep working conditions good at all times.

As our young men and women grow and succeed to management posts, we must find ways and means of assigning to each the maximum practical authority, because we know that men grow fastest with responsibility and because experience has taught us that the business succeeds best with the most decentralization of authority.

Finally, we must at all times train and develop our management people in terms of the problems of the business as we see them five or ten years from now, because we know by experience that it will then be a much larger and more complex business.

Internal Competition

When the American people substituted regulation for competition in the telephone business, one might think that the public was fully protected. Yet not even regulation can protect the public against a management which becomes complacent or lethargic—one which says to itself, "The service is good enough. Why make it any better? Why expand and take the risks of growth or change?"

Earlier managers of the telephone business foresaw this danger—the lack of the competitive urge—and adopted many precautions against this insidious disease of complacency. I would like to tell you briefly of one of these which I mentioned earlier—the development of a system of internal competition among all of our management people. This development flows directly from the policy of giving the best possible service.

We recognize the need on the part of our people in management for some strong competitive urge. We provide this by a very simple process: we measure the results of operations on a very broad scale down to the small supervisory unit and up to the company as a whole or, in other words, to the president. Thus each supervisory foreman's results in our Plant Department are compared first against those of like foremen in his district. Commercial managers' results are compared with others in the district. Chief operators' results are compared. These results deal not only with quality of service in a technical sense, and with costs, but with the courtesy and consideration exhibited by each supervisor's employees in their contacts with the public. They cover a broad field of measurements in terms of public reaction to our service and to the company.

As we move up the line from the small unit, these comparisons are continued and extended. Thus, district managers' results are compared. Department heads' results are compared. Finally, the parent company assembles these data and each Operating Company is able to compare its results and those of each of its major departments with the best results obtained elsewhere in the United States.

These data are invaluable not only in correcting and improving service from the customer's standpoint but in affording a sound background for promotion. We have, as you know, a long history of promoting from the ranks. I and each of my officers started at the bottom, in one department or another, and that is true throughout the Bell System. When opportunities for promotion occur, we try to get the best man, no matter where he is in the Company. For the more important posts, we look both within the Company and elsewhere in the System.

This internal competition, together with the constant urge for improvement in over-all operating performance, in good public relations, and in sound personal relations, works well in insuring the promotion of young men who demonstrate that they can accept responsibility. Each can go as far as his abilities will take him. The tradition of seniority as the principal or most compelling reason for promotion has had no part in our business.

Effect of the Policy on Profits

THE LAST PART of the public policy relates to profits.

It is significant that the policy uses the phrase "at the least cost consistent with financial safety." That does not mean some minimum rate of return barely sufficient for survival. It does mean that the management publicly undertakes to determine the profit requirements and to put any additional earnings into service improvements or reductions in rates or both.

You may well say to yourselves, "Why, that is all right for the Telephone Company. Its profits are going to be regulated anyhow under the law. But it isn't practical in my case." Actually, the commitment has had far more significance in our regulated business than you might think. It resulted in fourteen major reductions in long distance rates between 1926 and 1944—most of them without any urge from any one outside the business. Thus a day station-to-station call from Los Angeles to New York which cost you $15.65 in 1925 costs $2.50 today. And the speed of service and quality of transmission have been improved enormously in the twenty-five years since the policy was stated.

The fact that the Company has publicly stated that it asks no more than is necessary for financial safety imposes a continuing sense of responsibility on management. This affects the day-to-day judgment of all management people, regardless of the fact that our earnings are regulated. We believe deeply in this policy. It has brought continuing action in service improvements, and action in reducing prices when this was practical. Unfortunately, in the last ten years of sharply rising costs, we have not been able to reduce our rates and, in fact, all Companies have required rate increases. But even during this period there have been numberless improvements in service, many of which have helped to offset rising costs.

THE POLICY also produces a by-product which may not occur to you. Every young management man and woman learns it as part of his business bible. There is a certain indefinable pride in being associated with a business that not only says it will limit profits but does so—using profits beyond those required for financial safety to better the service or reduce the price. This, I believe, helps us get and hold the kind of people we have.

Lest any one misunderstand me, I want to make it clear that I believe in profits. I believe that the right of any citizen, under the American scheme, to make all the profits he can providing he does not harm society in the process, has helped make our country great. But making all the profits he can in the long run will certainly be about the same thing as providing the best of goods and services he can in a competitive economy. If he is to be in business a long time, he must invest money in economies and improvements for the public benefit, since otherwise someone more enterprising will take his market. The man who thinks of his customer first is likely to last longer and prosper more in the long run than he whose eyes are fixed on his own immediate return.

Freedom to Do Our Best

I HAVE SPOKEN about what seem to me four of the major advantages of operating under a stated policy.

I am going to mention a fifth which is, in a sense, both a cause and an effect of these four and some others I have not mentioned.

This fifth advantage is that having a good policy and living up to it has persuaded the public to give us, in large measure, the freedom to do our best.

The policy said that we would give the customers the best service possible. They believed us and let us try. With that freedom we could spend money in research, put huge sums into plant improvement, pay good wages and get good people. In being allowed to do these things, we could render the good service we promised.

Business—the Basic Profession

NOW I HAVE some diffidence in making any concrete suggestions about the contents of a policy statement for any business but my own.

Nevertheless, I cannot help thinking that, as every business has an obligation to serve the public and as every business that has a pride in itself and a hope for the future must serve the public well, it might be useful to tell the public so, and also useful to tell the employees that such is the policy of the enterprise.

It might also be useful for a business to make it known that it was its policy to be a good citizen wherever it operated. The definition of a good citizen might include anything from good wages, good conditions of employment, support of local social services—all depending on the kind of business and the visions and convictions of the management.

But whatever its details, the statement would help give the public a picture of the character of the enterprise, and it would help mold people coming up in the business into that character.

Justice Holmes said: "Every calling is great when greatly pursued." Business—the providing of the goods and services by which men live and prosper—is the basic profession. For those who practice it to profess what it is they are trying to do is certainly a reasonable program.

The greater part of the people in the United States are in business. If the standards, aspirations, and objectives of business were constantly stated and lived up to, it might well increase our belief in our own purposes, to the benefit of everyone. And it is possible that the very act of stating objectives might lead to their clarification and also to the performance of them. A man cannot well be proved lost who has made no determination of where he is going. But one who has stated where he is going may be held to the path by his employees, his customers, or the public generally.

THIS MANAGEMENT ASSOCIATION was organized so that men in business could tell their experiences one to another for whatever benefit to business in general such an exchange could give.

I have spoken of the effect of operating under a stated policy because over the years the conviction has grown upon me that having such a policy and living up to it has been perhaps the most effective thing the Bell System has done in my lifetime.

I do not know whether some kind of publicly stated policy would be equally useful to you. But I see no reason why it should not be, and this is why I am reporting my experience tonight.

A GREAT AMOUNT and wide variety of telephone services contribute essentially to this nation's defense. Fast two-way voice communication is essential to industry and industrial use of the telephone has steadily increased all through the organization and expansion of the defense production program.

Many defense telephone needs parallel those of World War II. But there is this difference: today the danger of enemy attack on the United States is greater, and measures to meet the danger have to be much more extensive and complex. Telephone facilities and services are an absolute necessity in the growing air defense system. The tremendous telephone growth of the last six years, and the availability today of new types of circuits, switching systems and other equipment, add greatly to our defensive strength.

New systems have been developed to spread air-raid warnings more quickly than in World War II. Private line networks have been installed for the Air Force to speed such warnings from regional control centers to key cities. To transmit the alerts from these key points to police and fire departments, Civil Defense units, hospitals, key industries and others, an entirely new system has been designed by Bell System engineers and is being produced by the Western Electric Company. This will enable the key point to "dial the color" of the alert—Yellow, Red or White. At all points to be warned the degree of alert is simultaneously indicated by colored lamps and a bell that rings a corresponding signal.

With these arrangements it will be possible to alert the entire United States in less than two minutes.

From the A. T. & T. Annual Report for 1951

The Old Ginkgo Tree

IT WAS a beautiful old tree, lifting its green hands to the sun, welcoming a hundred springs, tall and sturdy through a hundred winters. Generations of children had played beneath its summer shadows, and in the autumn its leaves turned to burnished gold and there would be a cloth of gold on the earth beneath its branches.

It *was* a beautiful old tree, and the people of Frankfort, Kentucky, loved it. It was a ginkgo tree, brought from Japan by one of Commodore Perry's men more than a hundred years ago and planted there on the old Averill place, on Washington Street. The telephone company heard about it first from Mrs. Marvin Averill, who wrote:

"The telephone company has purchased the old Averill home, where I was received as a bride and spent many happy days. I live across the street now with my daughter. All the people of Frankfort love our old tree. We hope it will continue to live for many years to come."

That presented a problem to the telephone company; for construction was scheduled to begin on a new telephone building there on Washington Street. How could the tree be saved? Telephone company architects tried to redesign the building, or move it back on the lot. Every effort was made to save the old tree, but to no avail. There just wasn't room for both building and tree. It had to be cut down.

But the telephone company didn't let the matter rest there. After discussion with the local Women's Club and Garden Club, it was decided to take cuttings from the tree. These were placed in hot-houses to sprout, and when they are large enough to transplant, they will be given to the people of Frankfort.

The lovely ginkgo tree *will* live again—multiplied many, many times to bring pleasure to future generations of the children of Frankfort, Kentucky. And when they are grown, they will tell *their* children of the famous old tree that never really died at all.

There'll be a new generation of telephone people, too. And we hope they will remember how those who went before them showed the spirit of good neighborliness—how they loved the old tree, too, and helped it to live again to shade not one but a hundred doorways.

As the Armed Forces Continue to Expand, the Bell System Recognizes Its Obligation—and Opportunity—to Furnish Them More Than a Technically Good Telephone Service

Meeting the Service Needs of Service Men and Women

Justin J. Murphy

BACK IN 1947, when the Bell System's job of serving the communications needs of our World War II service men and women was just about wound up—when "attended" centers in military establishments were practically extinct and the last camp manager had returned to his normal responsibilities—any one who predicted that the System would be back "in the camps" in 1950 would have had a hard time finding an audience.

Yet on June 25, 1950, the now famous 38th parallel was crossed. And in the 22 short months since the Korean war started, our fighting forces have grown from 1,500,000 to an estimated 3,500,000 men. Uncle Sam has expanded, reactivated, or built new in this country over 500 army and navy establishments, air force bases, and hospitals. And the Bell System is matching this growth just as fast as the necessary facilities can be provided.

More and more, as the international situation forces our nation to build up its armed strength, it appears certain that Service for Service Men will be, for years to come, a prime responsibility and privilege of the Bell System.

Even without a national program of Universal Military Training, it's a rare young man these days who has not already had or will not as he grows older have a tour of duty in one of our armed services. And growing numbers of our young women also are now or will be service veterans. The uniform has an increasingly more permanent status in the wardrobe of our nation's youth.

The Bell System, therefore, in its role as the nation's prime communications supplier, has set out on a continuing basis to meet in full the human, personal needs for communication of our men and women whose normal life's pattern has been in-

The telephone center in a large military establishment. Signs and lights make it easy to find by night or day

terrupted by their patriotic obligations to their country.

Depending on their branch of service, the timing of their training, or their particular assignment, our service men and women may be in a Reception Center, Army Training Base, Staging or Rotation Area, Bomber Squadron Base, Naval Air Base, Air Force Base, Naval Training Station, or a permanent Fort—to name only a few. They may be in an establishment with from several hundred others up to as many as 50,000. And the pleasure of serving them is heightened by the realization that in many cases the calls they make here are likely to be their first completely personal experience with the Bell System and with Bell System service—particularly long distance service. First impressions are often lasting, so we want these to be pleasant, warm, and friendly. And we try to see to it that these initial impressions are confirmed time and again as our service men and women avail themselves of our facilities.

Following "John Q. Serviceman"

PERHAPS the best way to understand what our men and women in uniform want in the way of public telephone service is to follow the high spots in the career of one of them, whom we shall dub John Q. Serviceman, from the day he reports to his Induction Center, located in some large city near his home, to the day he is honorably discharged.

In the Induction Center, John Q.

will, in the normal course of things, take his physical and other prescribed tests. Assuming he passes them all, he becomes a full-fledged member of Uncle Sam's armed forces. And the first thing he'll do, when he steps out of line, will be to call home! Here starts a chain of telephone calls—a chain that represents a continuing challenge to the Bell System's traditions of service.

John Q. will go on to one of several Reception Centers located on a regional basis about the country. Here, with other "inductees," he will be strictly confined to a given area of the camp and, again, at his first opportunity he will call home—to let his family know he's arrived safely. At this point he knows he will be at the Reception Center for about six days—but he doesn't know where he goes next! So, he'll call again when his indoctrination period is over and he is ordered to move on with his detachment to still another location, generally a "training" base. Picture, if you will, bus- or train-loads of raw recruits arriving by the hundreds—and all heading for the telephone at their first opportunity. And picture the even more pressing desire of these same men to telephone when they are "moving out."

Bell System experience in such instances indicates that more is required than just installing enough public telephones. Ordinarily, the

Above: Inside a telephone center. At the rear, men are lining up to place their calls; those on the lounges are awaiting their summons from the loudspeaker

Below: Employees are carefully chosen for service at the busy switchboards at big Army and Navy installations

routine of the day means a rush for service in the evening hours, say from 7 P.M. to 10 P.M. The concentrated call load at that time requires the most efficient use of available telephones and circuits if the maximum number of men is to be served as speedily as possible. In the large establishments, therefore, "attended" centers have been established with from 10 to 30 telephone booths. Here specially selected and trained Traffic Department personnel will record John Q's call, invite him to relax in the comfortable surroundings of the center while we are handling his call for him, and then, when the distant party is reached, will page John Q. over a loudspeaker and direct him to an available booth. When he is finished, he sees the cashier, who will have a "timed and rated" toll ticket on his call, will quote the cost, including tax, and will accept his payment and thank him for it.

About 25 per cent of our attended centers are so-called "modified" centers, and differ in operation from the "full" attended center just described. For example, John Q., as he enters the center, receives a ticket with a number on it from an attendant. We found out early in the game that John Q. doesn't too much mind "standing in line"—but it's fatal to take care of any one else ahead of his proper turn. When his turn comes, his number is called over a loudspeaker and he is assigned the next free booth equipped with a coin telephone. He places his own call and, on its completion, is quoted charges and pays for his call by depositing coins in the coin box. If his call is delayed for any reason, an attendant handles subsequent reports for him. Change is made by the attendants—who will assure you from experience that John Q. definitely plans to run out of words before he runs out of change.

Most of John Q's calls are toll calls, and the methods just described apply to them. There is also in many places a large volume of local calling. In such instances, it is customary to segregate a group of booths with coin telephones connected directly to the local central office, so that local calls can be handled directly without effect on the toll traffic. The attended center—or centers, in the largest establishments—is, of course, supplemented by public telephones, well distributed throughout the camp. These are strategically located in or

Directional signs are strategically located throughout the camps near PX's (the serviceman's general store), in service clubs, officers' and N.C.O. clubs, near theatres, bus stops, or in locations centrally spotted to reduce to a minimum the walking time required to reach a public telephone from any part of the camp. It has been found most effective to "group" such public telephones—that is, to install more than one public telephone at a location—rather than to spread individual booths throughout the camp. Outdoor booth locations are especially worth while, since they are available for use 24 hours a day.

LONG DISTANCE CALLING FROM CAMP KILMER

This camp manager (right) is one of many Bell System men on such assignment

Behind the Scenes

AT THIS POINT in our narrative of John Q's experiences, it might be appropriate to look behind the scenes of the telephone service he is offered and consider the plans and objectives of the Telephone Company offering it. Generally, a military establishment of, say, 5,000 to 10,000 men will have a camp manager—a Commercial Department employee, who will devote full time or part time to the job, depending on the requirements. Such establishments will generally have one attended center. In the largest establishments, additional camp managers will be assigned on the basis of one for about every 15,000 men, and attended centers will be established on the basis of about one for every 10,000 men. System average is about five public telephones per 1,000 men, in the larger establishments.

Should the reader find that these formulas have not been applied to a location with which he is familiar, he will probably discover some special circumstance responsible, as for example, where much of the population of the establishment lives away from the grounds or is free to leave the grounds on completion of the day's responsibilities. In the Bell System, there are now about 100 camp managers on the job, and over 100 attended locations have been established. As this article is written, the Telephone Companies are pushing forward their plans for more public telephones, more attended centers, and more camp managers to keep pace with the growth of the armed services.

The camp manager is the key man on whom depends the ability of our Companies to plan adequately, and in advance, for the telephone needs and comfort of our service men and women. Moreover, he is usually responsible for the provision of adequate administrative service for official military use. He constantly studies the telephone service requirements of the camp and negotiates for the buildings to house our attended centers.

Sailors are likely to find telephones waiting for them on or beside the dock when they come ashore

Since some military establishments are as large as a city, and their population as highly transient as a metropolis, the job of directing John Q. to the nearest attended center or public telephone is one that deserves and gets considerable attention.

Maps of the area, showing public telephone locations, are often displayed on bulletin boards and at other vantage points. Signs, large and small, standard or hand-made to suit the need, are spotted and spotlighted advantageously throughout the area. And each big sign location and power outlet needs clearance with the Post Signal Officer and Engineer.

In many of Uncle Sam's permanent installations, the Government provides its own cable plant and switchboard facilities. In such cases, Bell cable "meets" Government cable just outside camp, and the camp manager must negotiate for the necessary pairs in the Government's cable to serve the public telephone requirements—not only those already installed but those likely to be needed as the communications needs of John Q. and his buddies grow.

The camp manager constantly evaluates the quality of the service, and prides himself on being available to give aid and information to our public telephone users—and to handle their questions and complaints. Jointly with our Traffic, Plant, Engineering, and Public Relations people, he arranges for furnishing and maintaining the attended centers. He recognizes the importance of adequate directories and sees to it that they are provided and replaced when necessary.

The People on the Job

Responsibility for the operating forces at the attended locations does not fall to the camp manager. Ordinarily, a camp chief operator will be in charge of the traffic operating forces. It is significant of the spirit with which the Bell System and its people have approached this job of "service to service men" that departmental lines are practically nonexistent in these military establishments.

The author has noted with pride how often the chief operator and her attendants have passed on comments and suggestions for improved service arrangements in and outside of the center, and how eagerly suggestions by the camp manager along the lines of overtones of service or protection of funds have been received by the Traffic personnel. Plant installation and maintenance people too go "all out" when called upon to do this job—and they're called on just about every day. These locations get top priority at the hands of our Traffic and Plant Engineers. And it goes without saying that the job done by our Long Lines forces is one of the important foundation stones of our service to service men.

In selecting furnishings and appointments for attended centers, the Companies have been guided by the desire to offer neat, attractive quarters which will make the service man feel welcome when he comes to place his call and comfortable during such unavoidable waiting intervals as he may experience.

Because of the high concentration of calling in the evening hours, an effort has been made to select furni-

In cities near military establishments, public telephone service is expanded to provide for the requirements of service men and women ture which will provide maximum seating capacity. Writing desks equipped with stationery are often provided, as are reading tables and copies of popular magazines. Pictures, perhaps depicting scenes of interest within easy traveling distance and time from the camp, decorate the walls. The Bell System zone map showing toll rates to points across the country is found in most centers, and has proven especially helpful to service men in estimating the cost of their calls before placing them. Heating and cooling arrangements are provided as appropriate to the location. In short, everything within reason is done to make their visit with us a pleasant one.

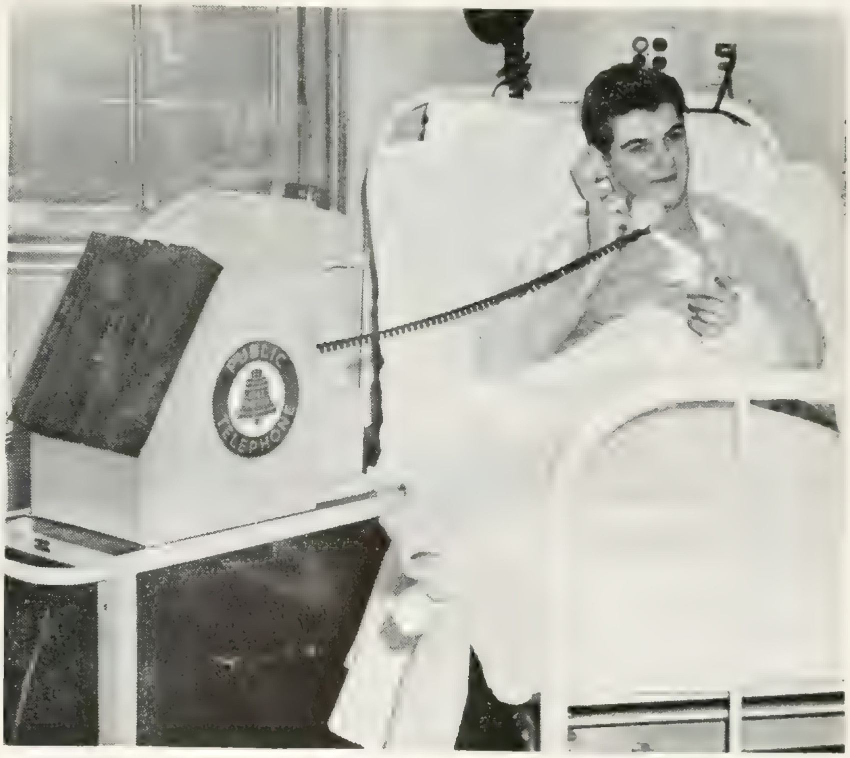
Oversized booths for wheel chair patients are available in hospitals

In selecting attendants for the center, particular care is exercised to assign people of warm personality. One need spend little time in a military establishment to sense how important it is that our people be willing and anxious to tune in with the serviceman—most often to help him place his call, but frequently just to give him a sympathetic person to talk to about the folks or the girl back home.

Often our attendants are the sisters, wives, or mothers of service people. Several Companies have been quite successful in hiring the wives of officers or enlisted men on the base. Camp managers quite often are ex-servicemen, who approach their assignment with sympathy and understanding because they too have been through the mill. All our people agree that it's a particularly interesting job, and attest that the satisfaction of helping our service men can't be evaluated by one who has not had the privilege of serving them.

Wherever He Goes

BUT LET'S GO BACK to John Q. Serviceman, who was about to leave his Reception Center for a Training Center. No doubt his calling needs will be much the same in the new location. Certainly he'll call home on arrival and again before moving out. Perhaps now, though, he'll have more freedom: will be able to arrange for visitors from home, and now and again will get away from camp on leave—generally of short duration. Plenty of need for telephone calling here—though perhaps for not as urgent reasons.



Portable telephones provide service for patients who are confined to bed

Should John Q. go to Norfolk, Va., or San Diego, Calif., he will find attended centers "down town"—designed to supplement the normal public telephone facilities of these cities and to further the comfort and convenience of our service men and women. In other cities near military establishments, the public telephone development in the center of town will have been reinforced to meet their requirements.

Having completed his stateside training, John Q. now goes to a staging area. Here he is prepared to go overseas—and here particularly the telephone must serve well. That last call home, with brave words of hope and good cheer despite the undertones of fear and heartbreak, must not go uncompleted because all trunks are busy or because the clock runs out before John Q's ticket is reached or his number called.

Here, special efforts are made to be sure that the service arrangements previously described are adequate to the peak loads they are called on to handle. We'll stay open and keep trying until the last call is completed or every possible effort has been made to get the call through. To distribute the load over all available facilities, camp managers often will take groups of service men, in buses provided by the Telephone Company for the purpose, to other centers in the camp. Where buses are not used, Company cars or government vehicles are pressed into service. "The call must go through" is a motto to live by for our service men and the Bell people who serve them.

When John Q. Comes Home

Now let's assume that John Q. has completed his service overseas and is about to return from Korea or Europe. Perhaps he's been relieved, will rest awhile at home, and then return to camp for reassignment. Perhaps he's about to be honorably discharged and the war is ended for him. Perhaps he's been hurt and is returning for hospitalization and convalescense. No matter what the reason for his return, it's "odds on" that the first chance he gets, he'll head for a telephone to call home.

If he comes through San Francisco

or New York City, as it's likely he will if he comes in by ship, he'll find public telephone facilities ready and waiting for him in the reassignment and displacement camp to which he'll be transported. Navy men will find special public telephone arrangements provided right on the docks or in groups adjacent to the dock at which their ship is moored. Moreover, Company telemobiles may be pressed into service to meet John Q.'s need.

If he is confined to a hospital, portable hand telephones, lightweight head sets for "hands-free" use, or coin bedside service (a coin box mounted on a telecart) will be available. For ambulatory patients, public telephone booths will be found in wards, the halls, and the lobby. Hooks will be found on which the injured can hang their crutches while using the booths, and oversized booths with special wide doors are provided for wheel chair and litter cases.

THE BELL SYSTEM has gone "all out" to give our country's service men and women the service they need where and when they want it. But Army camps, air force bases, and even some naval stations have a way of springing up in places where there are little or no facilities. Then, too, shortages of critical materials, such as copper, have added to the difficulties of the problem. But there has been no shortage of Bell System understanding or of determination to do the job. Bell people, dedicating their know-how and their energies to the men and women who have dedicated their lives to our country's defense, have made giant strides in meeting their telephone service needs. That these efforts are appreciated is amply demonstrated by commendatory letters written to the Companies, comments made to telephone people, and remarks written in Guest Books often provided at attended centers.

But the greatest testimonial of all, to any one who has been there to see, is the smile of happiness that lights up the faces of so many of our men and women in uniform when the magic of the telephone brings them close again—voice to voice—with their loved ones at home.

And in the years to come, as our service men and women move on to other successes in their peace-time occupations, we hope they will all remember with pleasure the real effort made by all Bell System people to see that their calls went through.

The men and women of the Bell System are its greatest asset. They served the nation well in 1951. Their ability and good spirit are the foundation for confidence in the years to come.

From the A. T. & T. Annual Report for 1951

Nearly Sixty Percent of Today's Telephones Are in the United States, Which Has a Telephone Development 20 Times the Average for the Rest of the World

How the Telephones of the World Are Distributed

Elizabeth Wrenshall

TELEPHONICALLY SPEAKING, "75" was the key number for the year 1951. There were nearly 75 million telephones in service throughout the world on January 1, 1951, and on March 10 of the same year the 75th Anniversary of the invention of the telephone was celebrated.

The world figure reflects a gain of 4.5 million telephones, of which more than half were added in the United States. With 43,003,832 telephones in service, the United States had 11 million more than all other countries combined. Although this country had little over six percent of the world's population, it had nearly 60 percent of the telephones, all of them operated under private ownership. More than two-thirds of the telephones comprising the global network are so operated.

The telephone has become an integral part of every-day life in the United States. Here, on January 1, 1951, there were twenty-eight telephones for every 100 persons, or 20 times the relative development obtaining in the world outside the United States. During the year under report, there was no change in the relative position of the principal countries either as regards number of telephones in service or telephones in proportion to population. There were ten countries having more than one million telephones in service: United States, United Kingdom, Canada, Germany, France, Japan, Sweden, U.S.S.R., Italy, and Australia. Six large countries reported more than 15 telephones per 100 of their population: United States (28.1), Sweden (23.9), Canada (20.8), Switzerland (19.9), New Zealand (19.1), and Denmark (16.9).

The great preponderance of the world's telephones are to be found in the industrialized countries of North

TELEPHONES IN CONTINENTAL AREAS

January 1, 1951[a]

Continental Area	Total Telephones			Privately Owned		Automatic (Dial)		Connecting with Bell System	
	Number	Per Cent of Total World	Per 100 Population	Number	Per Cent of Total Tels.	Number	Per Cent of Total Tels.	Number	Per Cent of Total Tels.
North America	45,933,800	61.4	27.5	45,554,400	99.2	31,923,300	69.5	45,916,800	100.0[b]
Middle America	555,000	0.7	1.1	511,100	92.1	385,600	69.5	549,000	98.9
South America	1,815,000	2.4	1.6	903,900	49.8	1,355,900	74.7	1,691,300	93.2
Europe	21,300,000	28.5	3.5	3,149,900	14.8	14,772,600	69.4	19,422,400	91.2
Africa	895,200	1.2	0.5	15,100	1.7	579,400	64.7	753,400	84.2
Asia	2,655,000	3.6	0.2	197,700	7.4	1,152,000	43.4	1,435,200	54.1
Oceania	1,646,000	2.2	11.9	109,600	6.7	1,040,800	63.2	1,631,900	99.1
World	74,800,000	100.0	3.1	50,441,700	67.4	51,209,600	68.5	71,400,000	95.5
United States	43,003,832	57.5	28.1	43,003,832	100.0	30,170,000	70.2	42,994,863	100.0[c]

[a] Partly estimated; data reported as of other dates have been adjusted to January 1, 1951.
[b] Less than 0.04 per cent do not connect.
[c] Less than 0.03 per cent do not connect.

America and Europe, which accounts for the relatively low development of the world at large. However, the value of telephone service is gradually being recognized in regions which do not enjoy our high standard of living. In Muscat, for example, on the Arabian Peninsula, where inland transport is largely by pack animal and where commercial interest centers in the cultivation of dates and in camel breeding, installation of a telephone system was undertaken during the past year. The nomadic Trucial Shiekhs on the Gulf of Oman, concerned with expanding their pearling and their fishery trades, have recently contracted for installation of a telephone system.

Telephone Statistics of the World, which presents statistical data relating to distribution of the world's telephones, is compiled annually by the Chief Statistician's Division of American Telephone and Telegraph Company. The data contained therein are supplied through the courtesy of officials of some 300 foreign telephone administrations.

For the purpose of this bulletin, only those telephones are counted which are available to the general public. Thus are excluded private intercommunicating sets and private line telephones used by railroads and other agencies which do not have connection with a commercial telephone system. Statistics are presented in so far as possible as of January 1, 1951. Those supplied for other dates are adjusted to January 1, 1951, in the computation of continental and world totals. Where current official data could not be obtained, as, for example, in the case of the U.S.S.R., the estimates shown are based on the latest data available.

Statistics showing the number of telephones, by countries, which may be connected with those of the Bell System are included in the bulletin. Overseas connection is still restricted in varying degrees within certain areas as a result of war conditions. For example, radio telephone service between Austria and the United States after the war was available only to members of the occupation forces, but international service has recently been resumed in the American Zone of Austria. Physical facilities exist for potential connection of a telephone in the United States with approximately 96 percent of all the telephones in the world.

Telephones Considered by Large Geographical Areas

For the purpose of analyzing the distribution of telephones, the land area of the world has been divided into seven major regions, based on the continents, sub-sections of the continents, and island groups. Subdivisions have been included within these major regions either because they are adjacent, or because they are to some degree homogeneous.

NORTH AMERICA

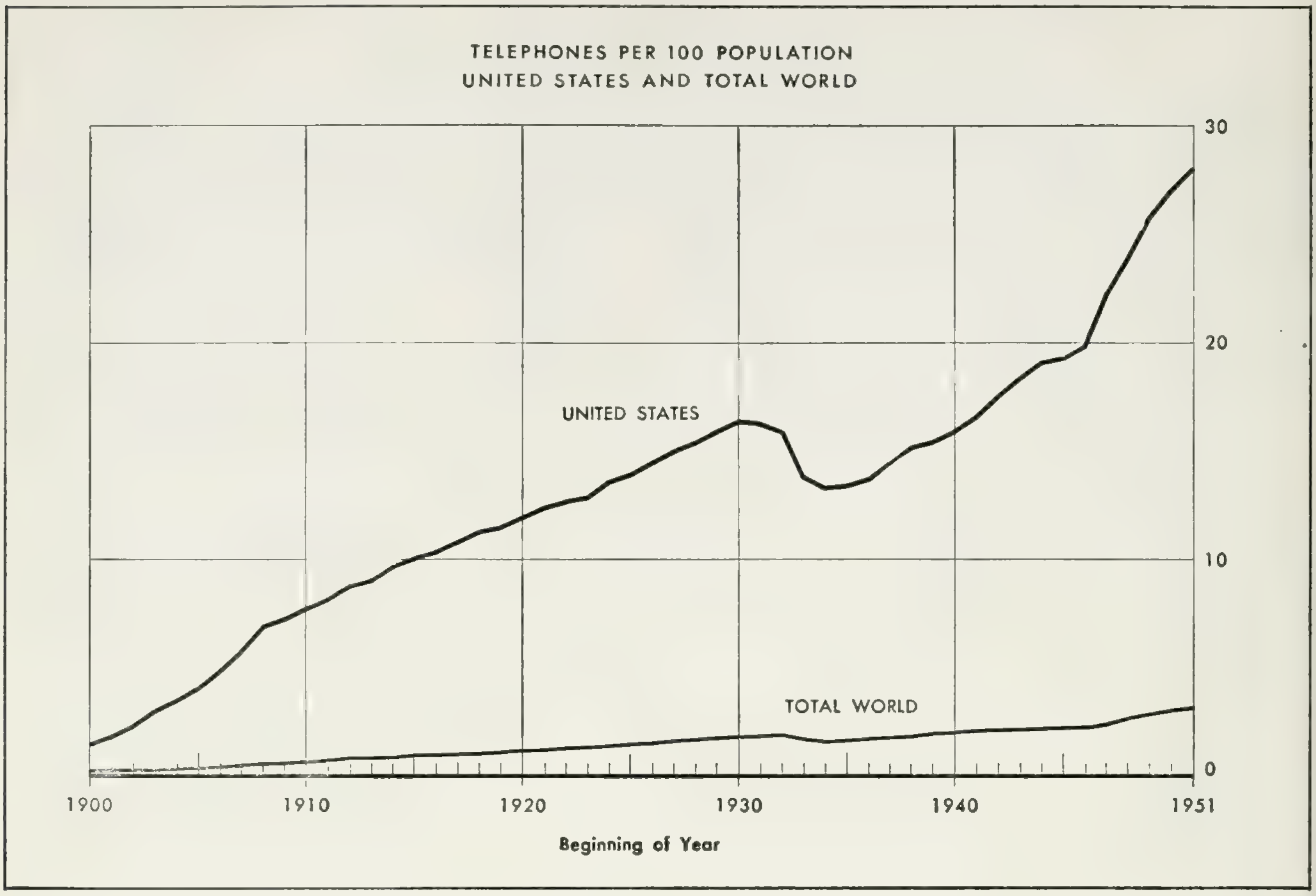
North America contains 16 per cent of the world's land area, seven percent of the world's population, 61 percent of the world's telephones. The regions here considered under the heading of "North America" include all of the continental area north of Mexico, plus the islands of St. Pierre and Miquelon, and Greenland. More than 99 percent of North America's total of nearly 46 million telephones are operated under private ownership. About 94 percent of North America's total telephones are in the United States.

The Bell System, comprising the American Telephone and Telegraph Company and its 20 Principal Telephone Subsidiaries, operated 82 percent of this country's telephones on January 1, 1951. The remaining 18 percent were owned and operated by about 5,500 independent telephone companies and 60,000 rural or farmer lines and systems. If this country had the same telephone density as exists in Europe, our entire population would be served by less than 5.4 million telephones, or about as many as there are in the three cities of New York, Chicago, and Los Angeles combined.

Contrary to the situation obtaining in the majority of foreign countries, good telephone service is available in rural areas of the United States. The Bell System has been extending and improving service in this field, installing rural telephones at the rate of 1,000 each work day.

A substantial proportion of the telephones in service in most foreign countries is absorbed by their respective principal cities, whereas in the United States a relatively small proportion of our total telephones are located in our largest metropolitan areas. The following list of countries, the principal city in each, and the percentage of the nations' total telephones serving such cities is illustrative: Argentina, Buenos Aires, 63; Brazil, Rio de Janeiro, 39; France, Paris, 26; Ireland, Dublin, 57; Italy, Rome, 19; Portugal, Lisbon, 42; United Kingdom, Greater London, 30; United States, New York, 7, Chicago, 4.

Canada, with 2.9 million telephones, has the third-largest telephone system in the world. The tele-



phone density, 20.8 per 100 of the population, is exceeded only by that of the United States (28.1) and Sweden (23.0). Canada has nearly 3,000 telephone systems, many of them small coöperatives which operate rural lines in Saskatchewan, Alberta, Nova Scotia, and Ontario. More than two-thirds of the total telephones serving the Dominion are in the Provinces of Quebec and Ontario; more than one-fourth of Canada's total are in the two cities of Montreal and Toronto.

In Alaska, fifteen privately-owned companies operate 17,841 telephones. Toll service within the Territory and international radiotelephone service are provided by the Alaska Communication System, which is a part of the United States Signal Corps. The Alaska Communication System also operates 78 telephones on a commercial basis.

The French Territory of St. Pierre and Miquelon, a group of islands near Newfoundland, has a government-owned system comprising 137 telephones.

Greenland, which is Denmark's only colonial possession, is more than one-fourth as large as the United States, but four-fifths of its area is covered by ice cap. Greenland has no commercially operated telephones, the existing system being available only to military personnel.

MIDDLE AMERICA

Half of Middle America's telephones are in Mexico, and half of Mexico's telephones are in its capital, Mexico City. Virtually all of the telephones in Mexico are operated under private ownership.

Cuba, with 122,668 telephones, has the second largest system in Middle America. Seventy percent of its telephones are in the city of Havana.

Bermuda, with 17 telephones per 100 inhabitants, leads all other countries within this grouping in regard to telephone density, followed by the Canal Zone with 7.6 telephones per 100 people.

SOUTH AMERICA

About four percent of the Western Hemisphere's telephones are in South America. Argentina, with 798,391 telephones, has more than any other country on that continent. Nine-tenths of Argentina's telephones are operated by the government, the balance by two private companies.

Brazil ranks second in respect to number of telephones in service in South America, with 549,700. With the exception of a small departmental system operated by the government, Brazil's telephones are privately owned.

In considering telephones in proportion to population in regions grouped under the heading of "South America," the highest development obtains within the little Crown Colony of the Falkland Islands, where 305 telephones serve the 2,300 inhabitants. On the continent, Argentina ranks first, with 4.6 telephones per 100 persons, followed by Uruguay, with 3.8.

About half of South America's telephones are operated under private ownership.

EUROPE

Europe ranks second to North America in respect to number of telephones. Of the world's 24,358,300 government-operated telephones, three-fourths are in Europe. Only 15 percent of that continent's telephones are operated under private ownership. As Europe's population is about one-fourth of the world aggregate, the telephone density is relatively low. Europe, on January 1, 1951, with an average of 3.5 telephones per 100 persons, had attained about the same telephone development as that reached by the United States in the year 1904.

The largest European system is that of the United Kingdom, with 5,433,614 telephones, operated entirely under government ownership. This system, considered on a world basis, ranks second to that of the United States in size.

Germany has the second-largest telephone system (2,725,213) in Europe. While accurate data in respect to Eastern Germany and Berlin are not available, an official estimate indicates that some 88 percent of Germany's total telephones serve the Western Zone.

The telephone system of France (2,405,802) ranks third in size in Europe, fifth in the world. Considering telephones in proportion to population, France's development of 5.7 telephones per 100 persons is relatively low.

Sweden has maintained its usual high degree of telephone development with 23.9 telephones per 100 population, thereby ranking second only to the United States in this respect. The government operates Sweden's telephones except for some 2,000 which serve half a dozen small communities.

Switzerland ranks second among European countries as regards telephone development, Denmark third.

AFRICA

The population of Africa is relatively small in proportion to its area, for this continent has, as have the Americas, large desert areas which have remained uninhabited. Africa has 22 percent of the world's land area, eight percent of its people, 1.2 percent of its telephones. The only privately-owned telephones in all of this vast continent are those serving two towns in Spanish Morocco, the Tangier Zone of Morocco, and the Spanish colony of Guinea, a total of 15,016, leaving more than 98 percent of the continent's total under government ownership. Eighty-five percent of Africa's telephones are in comparatively small areas along the north coast and in the southernmost territory, the Union of South Africa.

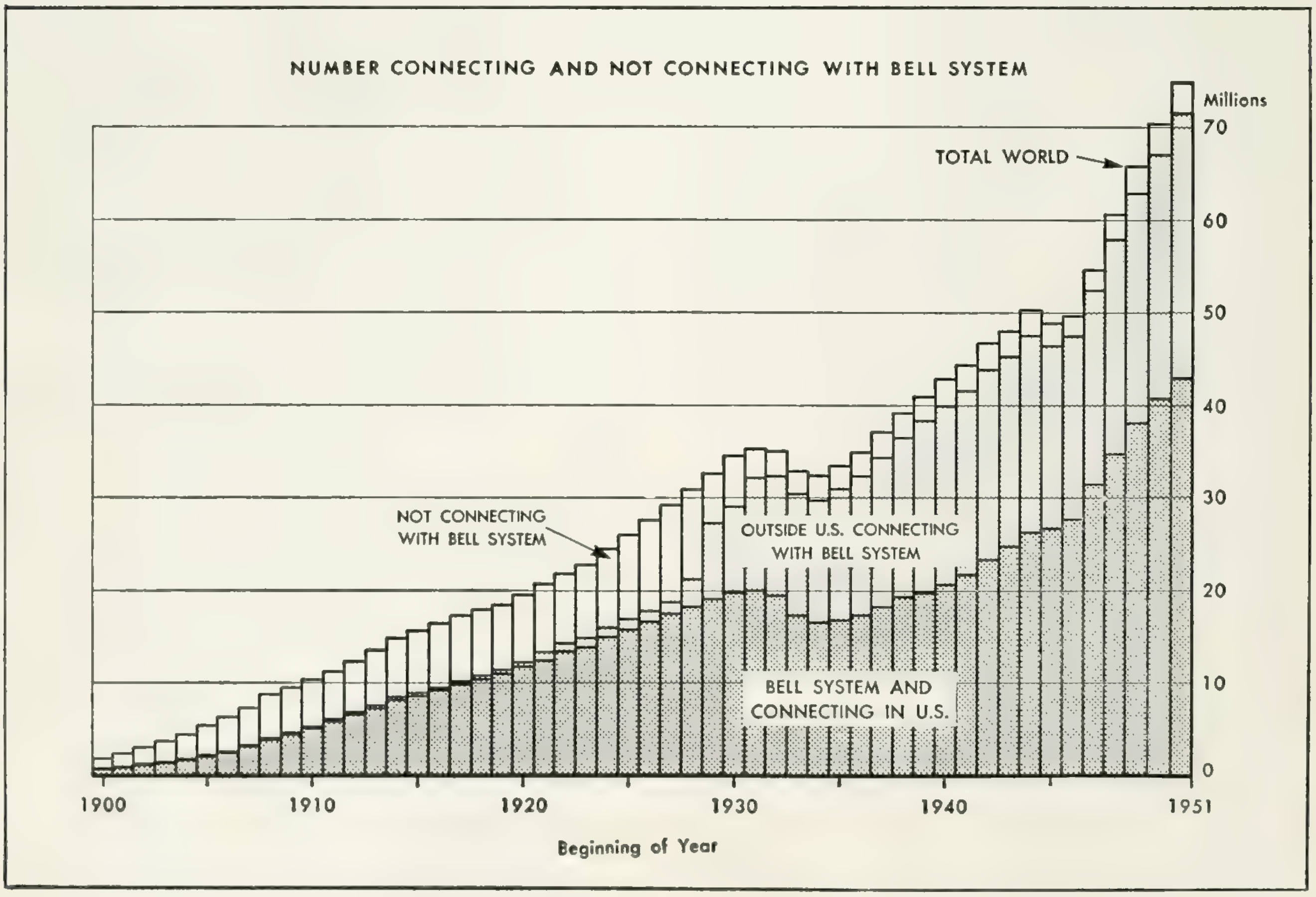
The Union of South Africa, with six percent of Africa's population, has 50 percent of its telephones. All of the Union's telephones are operated by the national government except those serving the business center of the city of Durban where they are operated by a municipal corporation.

Egypt has the second-largest telephone system in Africa, with an estimated 115,500 telephones, more than one-fourth of them being in Cairo.

Algeria's system, operated by the government, ranks third in size on this continent. About one-third of the telephones serving the Algerian territory are in the city of Algiers.

ASIA

The population density in Asia is extremely high, being more than two and one-half times as great as that of the world as a whole. Although more than half of the world's people live in Asia, they are served by



less than one twenty-fifth of the world's telephones.

More than two-thirds of Asia's telephones are in Japan (1,802,558). Japan's telephone density of 2.14 per 100 persons is the highest in Asia, closely followed by that of Israel (2.11). The telephone systems in both countries are government operated.

Although China ranks second in respect to number of telephones in service in Asia, with an estimated total of 225,000, it has more than one-third of the population of the continent, or about one-fifth that of the total world, resulting in an extremely low telephone development. There is only one telephone available, on the average, for every 1,820 persons in China. India's telephone system is third-largest in Asia, but here, too, the telephone density is low. India, on the average, has but one telephone for every 2,150 persons.

OCEANIA

Australia and New Zealand together account for a major portion of both population and telephones in Oceania.

Seven-tenths of Oceania's telephones are in Australia. Telephone distribution in Australia's six largest cities is relatively even, ranging from 13.7 per 100 persons in Perth to 18.7 in Melbourne.

New Zealand's telephone system ranks second in size and in density among those serving countries in Oceania. In New Zealand, the telephone development of the country as a whole is about equal to that of the average of the four largest cities.

Hawaii, with 21.9 telephones per 100 of the population, ranks first in Oceania in telephone density. A privately owned company operates all of the telephones in service within the Territory.

Conversations

TELEPHONE CONVERSATION data are not available for all countries. The United States showed 371 telephone conversations per capita for the year 1950, compared with 362 for Canada. As regards other countries served by the world's largest telephone systems, the United Kingdom reported 67 conversations per capita, Western Germany 43, France 37, Japan 67, and Sweden, with the world's seventh-largest telephone system, reported the relatively high calling rate of 313 conversations per capita.

Urban Telephone Development

NEW YORK was served by the world's most extensive urban telephone system, and, speaking telephone-wise, Greater London was the best equipped among foreign cities. Washington, D. C., attained a higher degree of telephone saturation than any other large city in the world, with 60.6 telephones per 100 persons. The only large foreign city to approach Washington in this respect was Stockholm (47.9). Telephone density in most of the large cities of foreign countries is appreciably lower than that obtaining in the great metropolitan areas of the United States, in spite of the fact that a large proportion of the telephones in foreign countries are concentrated in their capital cities.

Running Into People

By Tom Seddon

In the Bell System he would be known as an installer. His tale is quoted from the Post Office Magazine, *publication of the British Post Office, which operates the telephone service in Great Britain.*
EDITOR.

SOME jobs are exciting. I was a telephone fitter for ten years and found it the most exciting job in the Post Office. I never knew whom I was going to run into next. Nearly every morning I was allotted a new job, and I met many people—some of them famous.

Dame Ellen Terry, the famous actress, playing in Liverpool, found me under her bed at her hotel one afternoon.

"And what are you doing in my bedroom, young man?" she said roguishly. "Nothing wrong, I hope, madam," I replied, and we both smiled.

I ran into Sir Thomas Beecham in the corridor of the same hotel. "Pen, ink and paper," he demanded from the chambermaid, flashing a glance at me.

I could guess what he was going to do; alter a score or write a snappy letter about the British public's lack of appreciation of good music. I admire Sir Thomas as a fighter.

I missed a budding M.P. by three inches at the Wallasey Town Hall. He was handing in his nomination papers and I was carrying a ladder. He ducked and retained his head, but I think he lost his seat later.

Over in the Isle of Man I was working on the landing of a private house in Douglas, when a bedroom door opened and out tottered an old man in pyjamas. He was so frail that I jumped to assist him.

"Who are you, young man?" he asked. I explained I was a Post Office fitter.

"Could you help me on with my dressing gown," asked the old man. And thus I had the honour of assisting Sir Arthur Conan Doyle, the famous novelist, who put the Isle of Man on the map. He died a few weeks later. . . .

The telephone fitter, in addition to running into people, runs into many interesting events. I remember helping to wire the Argyle Theatre, Birkenhead, for its first B.B.C. broadcast; wiring the House of Keys in the Isle of Man for the official opening of the submarine cable from England to the Isle of Man; and helping with a few T.T. Race * telephone hook-ups. The Isle of Man telephone staff run the telecommunication system linking up all the main points around the Course to the grand-stand and, on race days, manning the posts. . . .

One hot summer day I trudged out to a large house in the wilds. I rang the front door bell. The maid allowed me in, but we were stopped in the hall by the mistress.

"Well, well," she said, shaking my hand, "fancy meeting you here! Mary, this gentleman will have afternoon tea with me in the drawing room."

An old friend? Why, certainly, she was. One of my subscribers from Wallasey, whose house I had visited on maintenance duties years before. She informed me that she had married a Canadian lumber-jack millionaire. I drank her health in tea.

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* Tourist Trophy motorcycle race.

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Bell Telephone MAGAZINE

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AUG 11 1952

Communication Sets Its Sights Ahead
HAROLD S. OSBORNE

Coöperative Leadership toward a Common Objective
JUDSON S. BRADLEY

The Bell System's Best Sellers · A. B. COVEY

On Being a Responsible Individual · CLEO F. CRAIG

Noted Old LD Lines Are Finally Retiring
RICHMOND B. WILLIAMS

erican Telephone & Telegraph Company · New York

Bell Telephone Magazine

Summer 1952

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A Medium of Suggestion & A Record of Progress

JUDSON S. BRADLEY, *Editor.* *Published four times a year for the supervisory forces of the Bell System by the Public Relations Department of the*
AMERICAN TELEPHONE AND TELEGRAPH CO., *195 Broadway, New York 7, N. Y.*
CLEO F. CRAIG, *President;* CARROLL O. BICKELHAUPT, *Sec.;* DONALD R. BELCHER, *Treas.*

Who's Who & What's What *in This Issue*

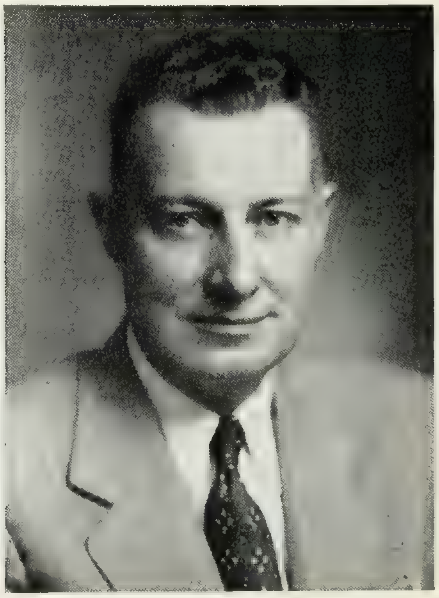
THE FIRST CONTRIBUTION that HAROLD S. OSBORNE made to this publication was "Standardization in the Bell System," and it appeared in the old BELL TELEPHONE QUARTERLY in the issues for January and April 1929. The article which begins two pages over, twenty-three years later, is the last of many. For Harold Osborne, Chief Engineer of the American Telephone and Telegraph Company since 1943, retires on August 31, after 42 years of Bell System service. Joining the A. T. & T. Co. in 1910, in the then Transmission and Protection Department, he was assistant to the transmission and protection engineer from 1914 to 1920 and then transmission engineer until 1939. He was operating results engineer 1939–1940, plant engineer 1940–1942, and in the latter year he became assistant chief engineer.

Mr. Osborne's "extra-curricular" activities are too extensive even to list here. Mention should be made, nonetheless, of his services to the Federal Government in various advisory capacities; of his long association with the American Institute of Electrical Engineers, of which he was president in 1942–1943; and of his part in the American Standards Association. He has been president since 1949 of the U. S. National Committee of the International Electrotechnical Commission, and sails abroad soon to be installed as president of the parent International Commission—the third American to occupy the office. A testimonial which certain of his associates presented to Mr. Osborne last February is reproduced on the opposite page.

AFTER SEVERAL YEARS of editorial and publishing activity, JUDSON S. BRADLEY joined the Information Department of the Southern New England Telephone Company in 1925 as copy manager, and was later made advertising manager. In 1928 he transferred to the A. T. & T. Co. in New York. A member of the Public Relations Department there since 1930, he has been closely

Harold S. Osborne

Judson S. Bradley



A. B. Covey

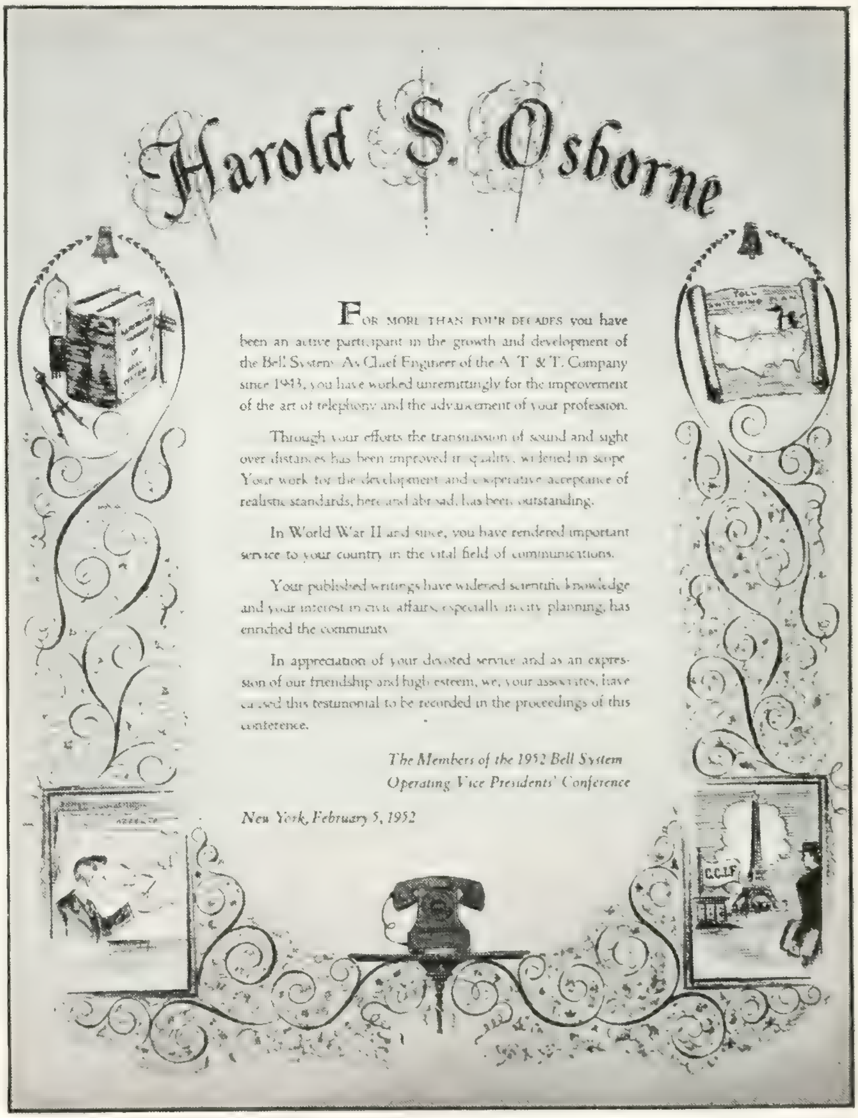
Richmond B. Williams

associated with this publication for 20 years, and has been its editor since 1943.

SINCE THE LATTER PART of 1951, A. B. COVEY has been coördinating the activities of the special group of Associated Company Plant and Engineering men about whom he writes in "The Bell System's Best Sellers," which begins on page 87. He joined the Southwestern Bell Telephone Company in 1923, and during the next four years held assignments in the General Engineering Department. In 1927 he became transmission and protection engineer of the Western Missouri and Kansas Area. Three years later he was made acting outside plant engineer. In 1930 he transferred to the Plant Engineering Division of the A. T. & T. Co.'s O. and E. Department, where he held various assignments in the transmission section. He has been associated with the defense activities section since 1951.

A PICTURE OF and note about President CLEO F. CRAIG will be found on page 77.

WITH THE Long Lines Department since 1926, RICHMOND B. WILLIAMS has held various responsibilities since that time—including that of editor of *Long Lines Magazine.* During World War II he was a member of the House Magazine Advisory Committee of the War Finance Staff of the U. S. Treasury Department, and in 1943 was chairman of the War-Time Conference of the National Council of Industrial Editors Association held in New York. Mr. Williams' previous contribution—"TR Receives His Summons to the Presidency"—which appeared in this MAGAZINE for Autumn 1951, aroused a good bit of interest among historians and others interested in that era, and copies have been placed in the archives of the Theodore Roosevelt Memorial Association, the New-York Historical Society, and those of the State Historian of the State Educational Department in Albany, N. Y.



Harold S. Osborne

FOR MORE THAN FOUR DECADES you have been an active participant in the growth and development of the Bell System. As Chief Engineer of the A. T. & T. Company since 1943, you have worked unremittingly for the improvement of the art of telephony and the advancement of your profession.

Through your efforts the transmission of sound and sight over distances has been improved in quality, widened in scope. Your work for the development and cooperative acceptance of realistic standards, here and abroad, has been outstanding.

In World War II and since, you have rendered important service to your country in the vital field of communications.

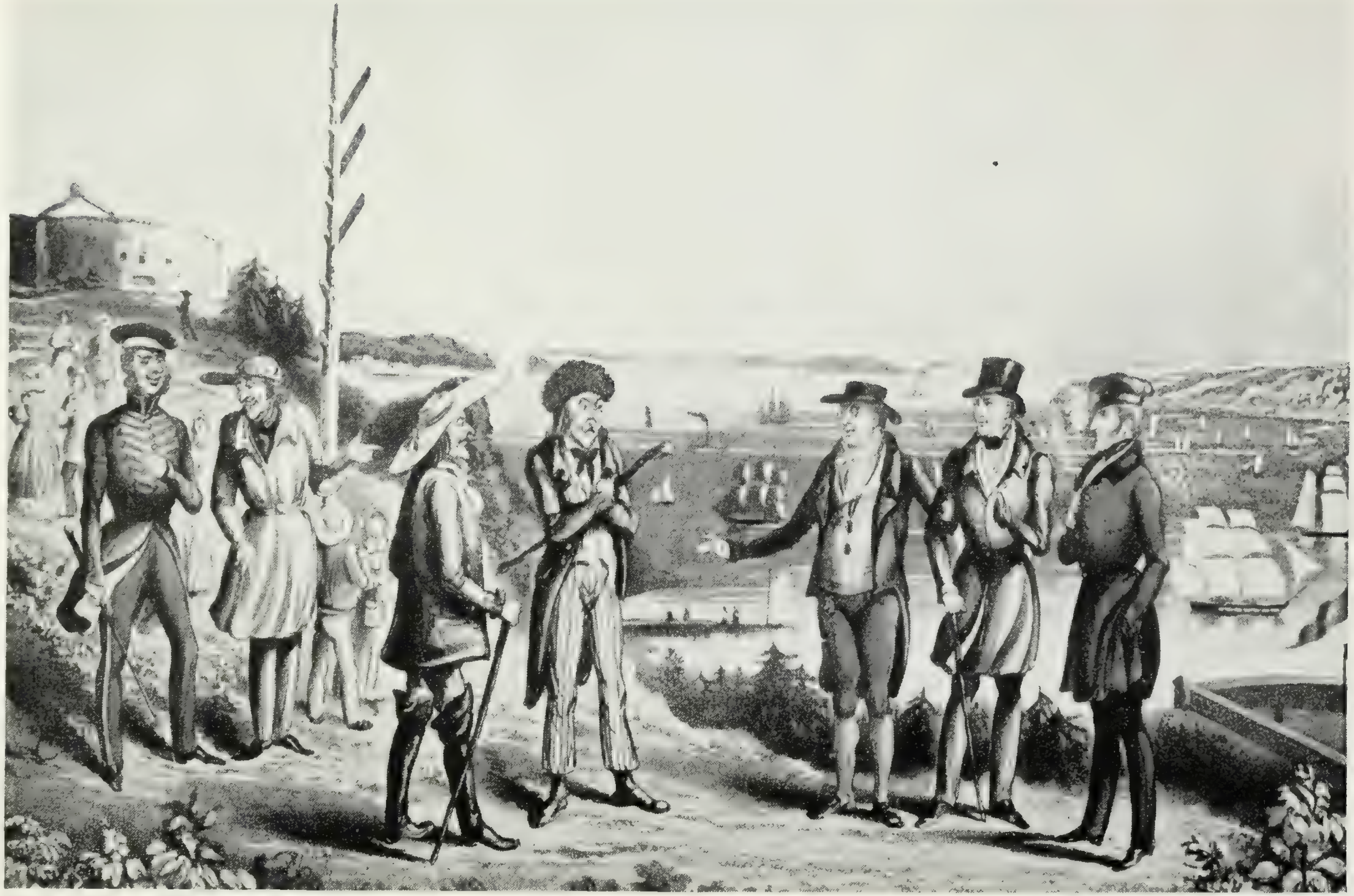
Your published writings have widened scientific knowledge and your interest in civic affairs, especially in city planning, has enriched the community.

In appreciation of your devoted service and as an expression of our friendship and high esteem, we, your associates, have caused this testimonial to be recorded in the proceedings of this conference.

The Members of the 1952 Bell System
Operating Vice Presidents' Conference

New York, February 5, 1952

This testimonial was accompanied by the signatures of forty-seven of Mr. Osborne's associates



"Radio Relay" in the 1830s: The semaphore on Staten Island, N. Y., in a setting drawn by the younger Cruikshank—an Englishman who obviously had never been there. See the article beginning on the opposite page

Many Factors, Including the Form of Organization of the Bell System, Combine to Stimulate the Continued Growth And Development of Telephone Service in This Country

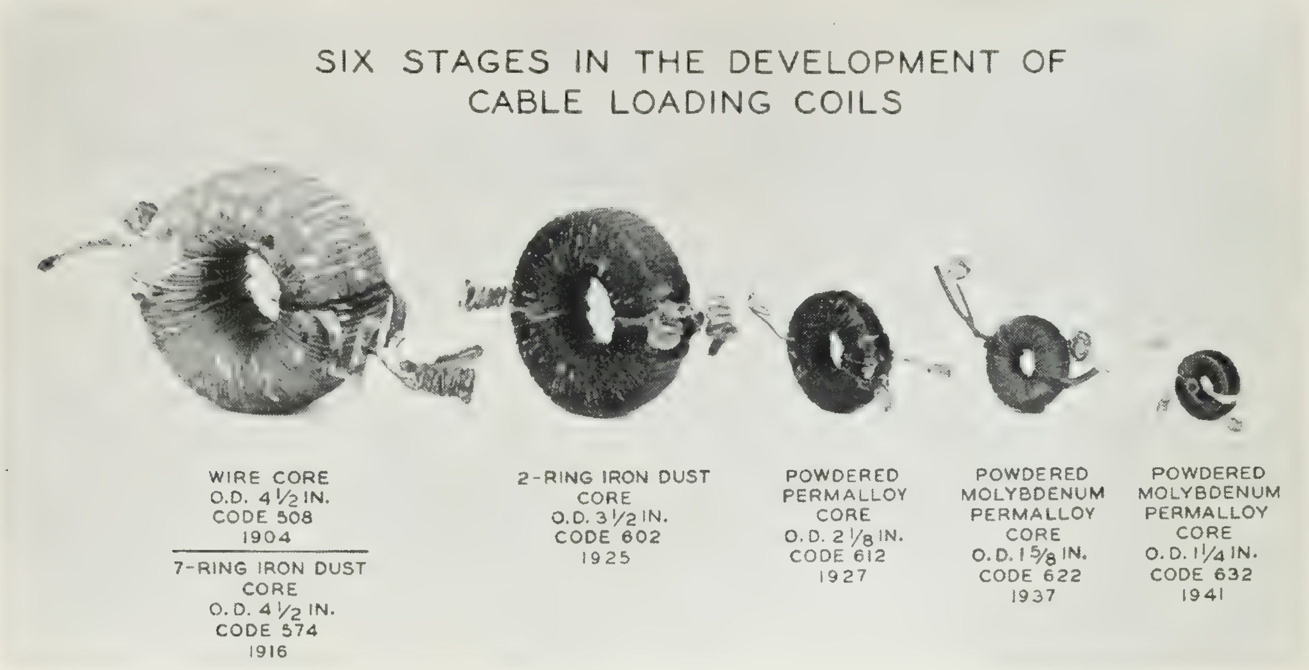
Communication Sets Its Sights Ahead

Harold S. Osborne

In the three-fourths of a century since the invention of the telephone, electrical communication has had a truly astonishing growth and development. In this country alone, there are not far short of 50 million telephones in service. The number of telephone conversations carried out among them each day is reaching toward the 200-million-mark. The telephone has become an essential tool of all business and industry. Seventy percent of all the homes in the country are equipped with it. As more people have telephone service, more people need it and use it. It continues to become more and more an integral part of all aspects of the national life.

Is it not possible, then, that electrical communication has become a mature art, in which we may expect future growth and modification but no extraordinary and transforming developments?

A prediction of this sort on a broader base was made in the report on "Industrial Depressions" published by the Commissioner of Labor in 1886, which presented the results of a careful economic study by representatives of the Federal Government. After pointing out that the necessary railroads had been built and that the economic tools in America and in Western Europe had been brought fully up to date, he concludes, "It is true that the discovery of new processes of manufacture will undoubtedly continue . . . but this will not leave room for a marked extension such as has been witnessed during the past fifty years or afford a remunerative employment for the vast amount of capital which has been created during that period. . . . There may be room for further intensive, but not extensive, development of industry in the present era of civilization."


SIX STAGES IN THE DEVELOPMENT OF CABLE LOADING COILS
WIRE CORE O.D. 4 1/2 IN. CODE 508 1904
7-RING IRON DUST CORE O.D. 4 1/2 IN. CODE 574 1916
2-RING IRON DUST CORE O.D. 3 1/2 IN. CODE 602 1925
POWDERED PERMALLOY CORE O.D. 2 1/8 IN. CODE 612 1927
POWDERED MOLYBDENUM PERMALLOY CORE O.D. 1 5/8 IN. CODE 622 1937
POWDERED MOLYBDENUM PERMALLOY CORE O.D. 1 1/4 IN. CODE 632 1941

This array of loading coils tells its own story

Today we are less likely to make such a serious mistake. The whirlwind rate of development of new scientific knowledge and its application has given us the habit of expecting new marvels in rapid succession.

One of the reasons for the continuing growth and development of the telephone system is that telephone service continues to become a better bargain.* It is cheaper in terms of hours of work. For example, the skilled workman who in 1940 had to work four hours to earn enough to pay his monthly telephone bill can pay it today with earnings of about two hours' work. As a result, more and more people feel that they cannot afford to be without telephone service in the home, and the extent of its use in business and industry is continually expanded. The indications are that this is a long-term trend, and will continue to stimulate the future development of the telephone system.

In addition to the economic trends, there are other technical and general trends of our national life which work toward the continued development of electrical communications, both in amount and in variety. In the long range, these general trends will have a great effect on the continued development of the telephone system.

a. The art of electrical communication continues to be developed rapidly.

b. Increased amounts and new kinds of communication service continue to be needed to meet the requirements of our rapidly developing social and industrial structure.

Development of the Art of Electrical Communication

THE INCREASE in the possibilities of electrical communication, due to the increase in technical knowledge and the development of new things, is rapid and extends through many fields.

---

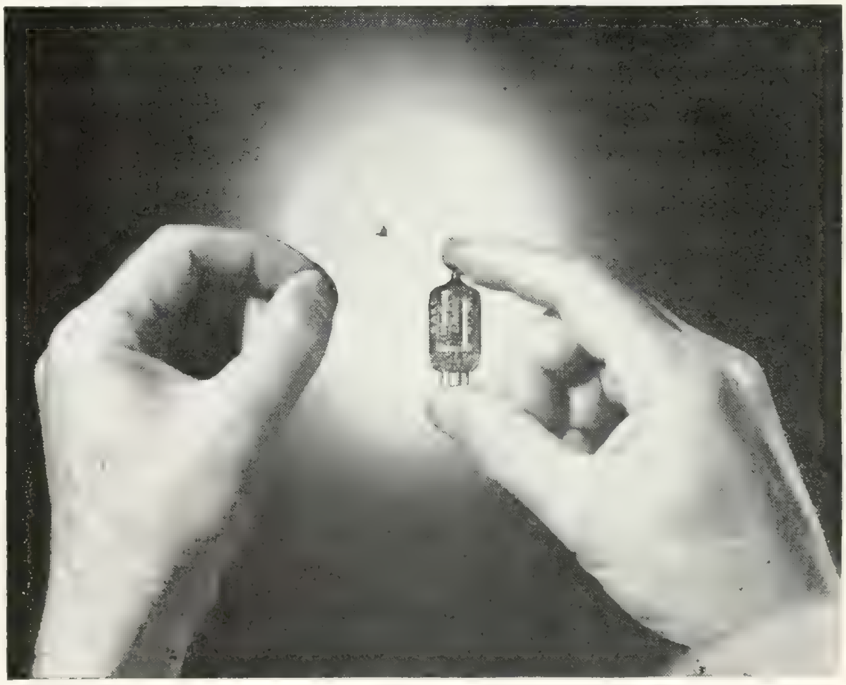
* See "The Telephone Looks to the Future," MAGAZINE, Spring 1952.

The development of the art comes about in part through the use of new materials, which are appearing with increasing frequency in this chemical age. For an example, consider the wonderful plastic *polyethylene*. While polyethylene has many uses in the telephone system, a striking illustration is its employment as a substitute for lead in the sheathing of telephone cables. This development alone made possible, right after the war, the rapid building up of manufacture of telephone cables to a level meeting the requirements of the Bell Telephone Companies: to a volume of 12 million miles of wire in cable in one year. With experience in its design, manufacture, and use, it is proving to have other advantages in many cases because of light weight and freedom from corrosion.

A quite different type of material fundamental to modern telephone systems is those ferrous alloys used to carry the magnetic field in myriad types of equipment. Iron was formerly used for this purpose. The Bell Telephone Laboratories over the years have developed new alloys of iron, nickel, and, in smaller quantities, molybdenum and other metals, which have extraordinarily improved magnetic properties. The bulk of certain types of loading coil, for example, has been reduced by 20 to 1 for the same use.

This is one illustration of a trend toward smaller and smaller volume in the development of modern communication equipment. This also helps to hold down costs, both because smaller quantities of material are required and because of the smaller space required to house the millions of pieces of apparatus necessary in a modern automatic telephone exchange or toll office.

The new materials help to make practicable new types of devices which heretofore were impracticable. For example, the transistor, a great invention resulting from extensive scientific research, makes use of the metal germanium, which is not new to science but is relatively new to industry. In its present form, it consists of a tiny piece of this metal which has first been purified to an extremely high degree and then subjected to the introduction of carefully controlled impurities of different types and amounts. The tiny



The tiny plastic bead of the transistor contrasts with the famed "peanut" (6AK5) vacuum tube piece enclosed in the plastic bead shown in the photograph has three sections, containing different types of impurity, and a wire connected to each of the three sections. This remarkable midget, connected with suitable circuits and modest sources of power, will amplify, modulate, or generate with extraordinary efficiency and economy the electrical currents required for communication. It seems destined to revolutionize a good deal of the construction and design of electronic devices.

New Systems of Communication

THE PROCESSES of invention and development weld many of the new devices, along with many pieces of apparatus and devices previously available, into new methods and systems for giving communication service. The influence of these new communication systems on the development of telephone service is marked.

One of the striking modern developments is the great extension of multiplex systems of transmission. The most recent of these "carrier" systems provides for transmission of 1,800 telephone conversations over one pair of conductors (in one direction) by use of different frequencies stacked closely together on the same conductors. This system is applied to the coaxial cable, and gives the ordinary coaxial cable having eight coaxial units a capacity for 5,400 telephone circuits—even after allowing for the assignment of one pair of coaxial units as reserve.

A second type of facility transmitting a broad band of frequencies and having a great capacity for multiplex operation is the radio relay. Beams of radiant energy using frequencies of four billion cycles and employing antenna horns and lenses ten feet square are sharply focused from tower to tower 25 or 30 miles apart. At the present time each radio channel has a capacity comparable with that of the L-1 coaxial cable system: 600 telephone circuits. This is sure to be increased with the further development of this remarkable new transmission system. Already 650,000 miles of telephone circuit are provided by this system, and its use is expanding rapidly.

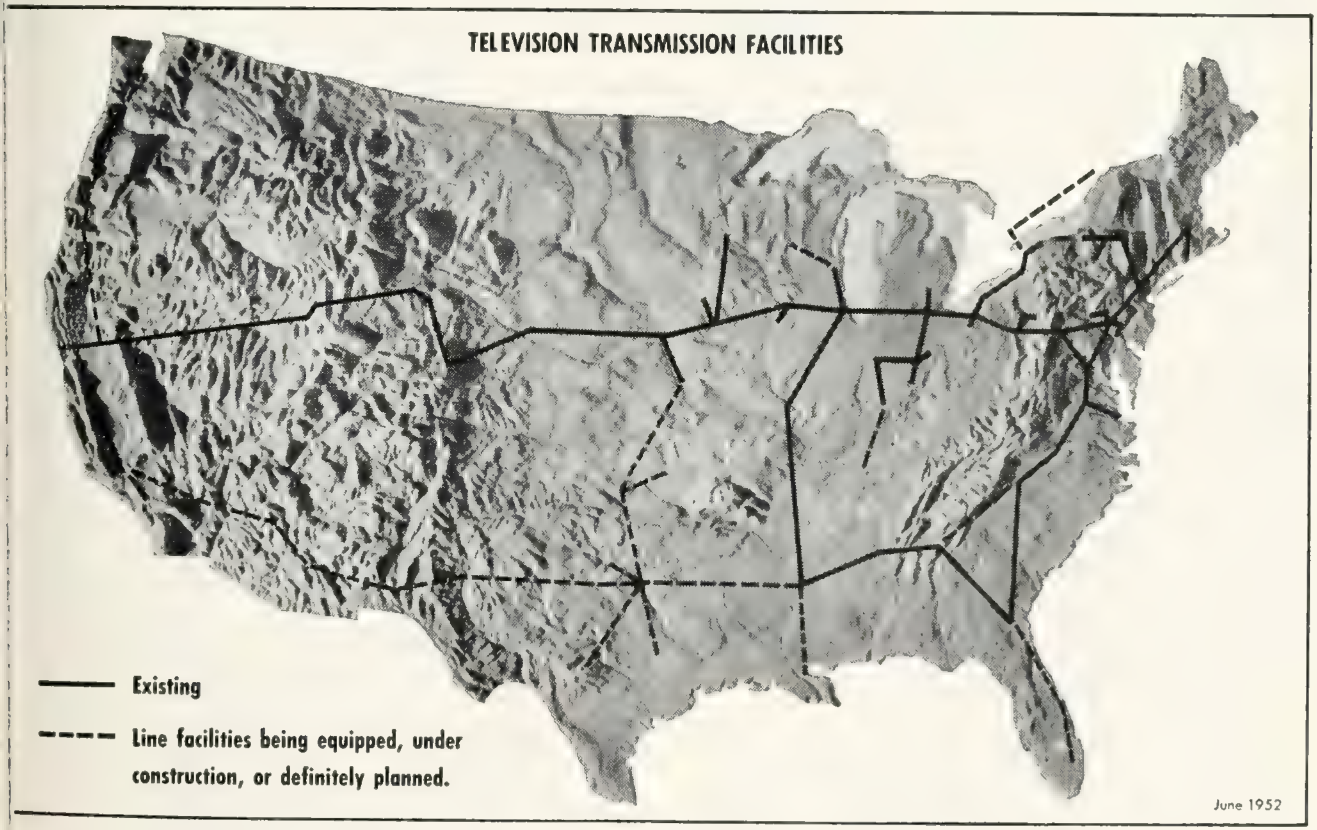
Techniques are being developed for the use of still higher frequencies for electrical communication. Experience today indicates, however, that when the frequency is pushed very much above ten billion cycles, the interference with transmission by rain and other atmospheric conditions increases rapidly. We quickly approach the limitations of the transmission of light itself. For still higher frequencies, therefore, it seems probable that it will be necessary to provide our own atmosphere. This can be done with what are called wave guides: i.e., hollow tubes like a coaxial unit with the central conductor omitted. Wave guides are already widely used for short distances in the apparatus of radio relay systems and of radars and other applications of the current ultra-high-frequency technique. They show promise of becoming the superhighways of communication of tomorrow—highways which will accommodate on each channel telephone circuits by the thousands rather than by the hundreds.

A special case of long distance telephone and telegraph transmission is presented by overseas transmission to the other continents of the globe. The present method of giving service, primarily by high-frequency radio channels, has served excellently for the establishment of the service and its development during the past 25 years. Now this method is rapidly being outgrown, both in the amount of service demanded and in the quality of service—which is increasingly important because of the growing dependence on this form of communication by government, industry, and individuals. For the long look ahead, it is safe to say that new techniques will be developed which will release this service from the limitations of the present transmission method.

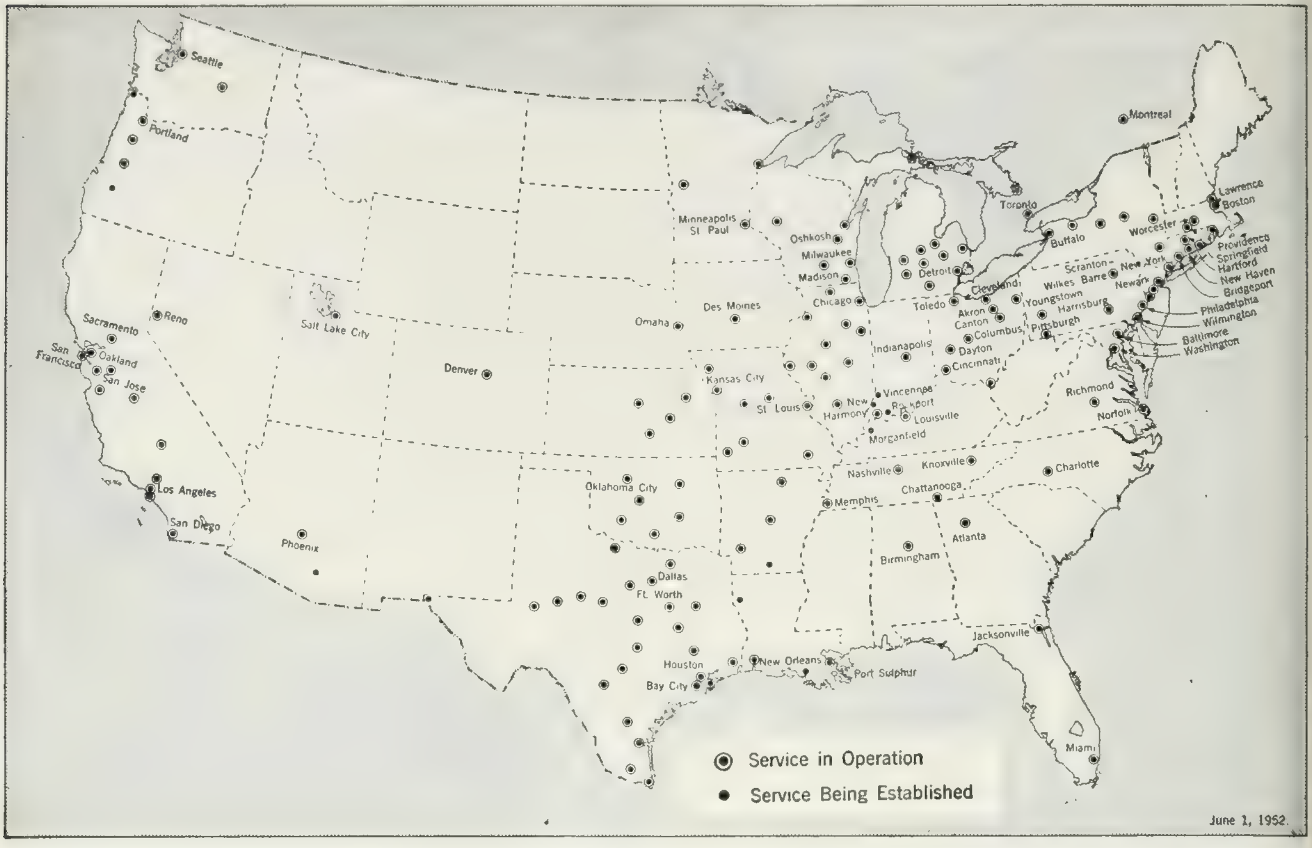
A good deal of progress has been made in one direction: namely, in the design of a telephone cable, equipped at frequent intervals with telephone repeaters, laid at the bottom of the sea and capable of transmitting numbers of telephone messages simultaneously through a pair of cables. The design of telephone repeaters which can be spliced into such a cable, which will survive the rugged service conditions of submarine cables, and which will operate for decades without requiring any maintenance, involves formidable technical difficulties. Such repeaters, however, are now in service on a cable between Key West, Fla., and Havana, Cuba, operating in water 6,000 feet deep. So far, in their first two years of life, they have given very satisfactory performance.

Development of Switching Systems

Along with the development of transmission systems, there have been —and are continuing—equally re-


TELEVISION TRANSMISSION FACILITIES
Existing
Line facilities being equipped, under construction, or definitely planned.
June 1952

The Bell System's current 25,000 miles of television channels in service are rapidly being expanded to twice that mileage



Bell System mobile telephone service is or will be furnished through special equipment in the cities indicated

markable developments in switching systems.

The use of automatic machinery for the switching of local calls has long been recognized as an economic and service objective, and has been extended to 80 percent of the telephones of the Bell System. Dial systems, as they are called, are complicated, and they constitute an increasingly important part of the equipment used in giving telephone service. Great strides forward have been made in recent years through the development of crossbar systems. Electronic systems of switching are the subject of active research. For the long pull, it seems safe to predict that great changes and improvements will come out of the research effort which is being applied to this important subject.

Today the Bell System Companies are proceeding rapidly with the extension of dial methods of operation of long distance calls—even on a country-wide basis. Some time ago a fundamental plan was developed by which a toll operator at any point will be able to complete long distance calls to any other point in this country or in Canada directly by automatic machinery without requiring the attention of operators at other points. The Bell System is well on the way to putting this into effect. At the present time, more than one-third of all toll board calls are handled in this way.

The central core of this system is the No. 4-type toll switching system, of which possibly 85 will be required for the complete nation-wide service and of which 16 are now in service. The first 4-A systems containing all of the features required for the nation-wide plan will be placed in service in Scranton, Penna., and Newark, N. J., early next year. These switching systems, when the plan is fully effective, will, when a call is placed, receive a 7-digit or a 10-digit number representing any telephone in the country and proceed with all of the operations necessary to complete the call.

The formulation of the plan of which this forms a part has required years of coördinated planning and study by the telephone companies throughout the country to provide for a national toll numbering system, toll switching and routing plans, and to determine specifically the functions which the 4-A systems must be capable of performing in order that the entire nation-wide system can work with efficiency and economy.

A remarkable feature of this development is a further improvement in the speed of long distance service because of the great speed with which the machine can make connections, test routes for available circuits, shift over to alternative routes, and find its way through the great dial network of the country to the called telephone number.

WHILE proceeding rapidly with arrangements for nation-wide dialing by the operator, the plan has contemplated from the start that nationwide customer dialing would ultimately be provided. With this in view, the 10-digit national numbering plan is based upon the local telephone numbers, with the addition of a minimum number of digits to represent the geographical area to which the call is directed.

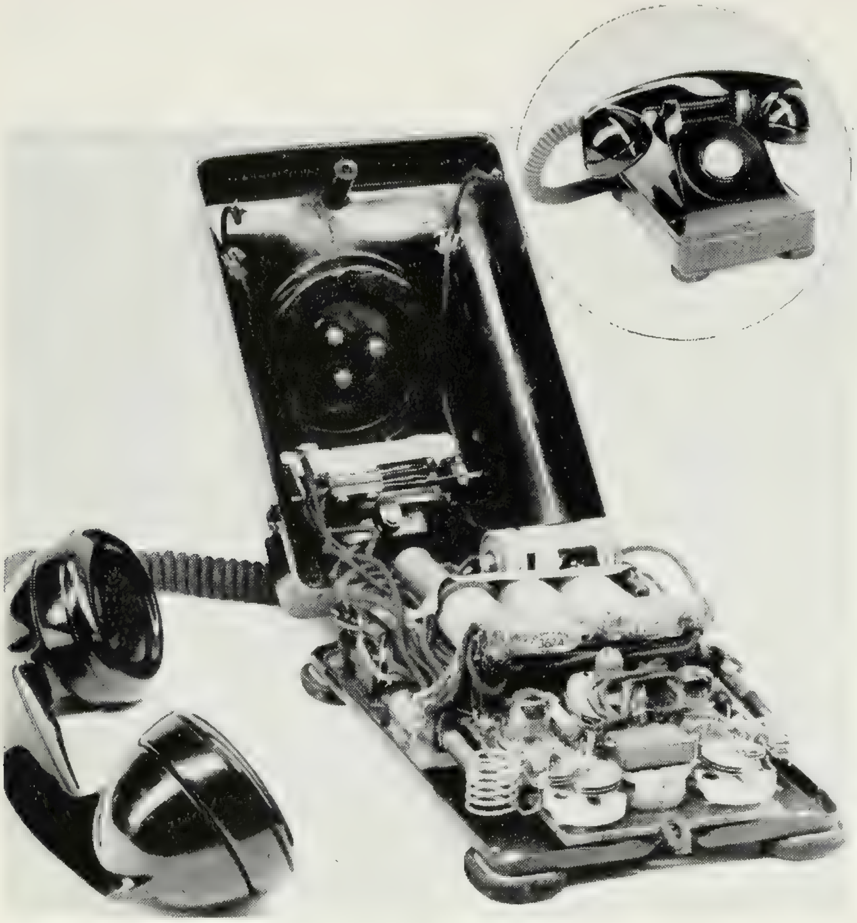
When the customer instead of the operator is to dial through to the desired telephone, an important added requirement is involved. With customer dialing, the machine must make automatically a record of all the details of the call upon which charges are based—a record which otherwise is made by the toll operator. Various forms of equipment to do this are now in extensive use for short-haul calls. Equipment suitable for general long-haul customer dialing is being developed.

In the meantime, a trial arrangement of long-haul customer dialing has been established in one local office: Englewood, N. J. Telephone users at Englewood can dial directly all telephones in any of eleven large city areas scattered throughout the continent from Boston to San Francisco. With this form of operation, the bell of the called telephone normally rings 15 or 20 seconds after the dialing is completed, compared with 90 seconds' average for the service given today.

The results of the Englewood trial are very encouraging. The customers are dialing 96 percent of all the calls it is possible to dial. Difficulties due to wrong numbers and other troubles are few. The new method is received with favor by the customers. It seems clear that this whole plan represents an impressive forward movement in the development of telephone service which will trend toward a continuing increase in the use of long distance service in the future.

Development of the Kinds and Quantity of Communication Needed

THE THIRD REASON for the continued development of the telephone



"Wireless Telephone": an experimental set containing a very-short-range radio, to eliminate the customary telephone cord

system mentioned at the beginning of this paper was the development of the needs of the American public.

A striking illustration of this is the current rapid development of television transmission. On September 4, 1951, the image and words of President Truman opening the international conference on the Japanese Treaty in San Francisco were brought across the country to be broadcast from the television stations throughout the East. This marked the inaugural of transcontinental television transmission facilities of the Bell System. The broad band systems, coaxial cable and radio relay, which are described above, are in fact the only available types of transmission facility capable of distributing television programs to groups of broadcast stations. That is because television transmission requires a very broad band transmission channel, comparable with that required for 600 one-way telephone channels.

The Bell System television transmission network now aggregates 25,000 miles of channel in service, and is rapidly being expanded to twice that mileage. Television is growing so fast that its future seems very promising. For some time, the number of television broadcasting stations in service was frozen at about 100 by the Federal Communications Commission. Recently the restriction has been lifted, and in the months ahead the Commission will probably grant many of the applications for additional stations now before it, more than 500 in number. More frequencies have been made available for television broadcasting, so that, in some cases, there may be as many as 10 channels available in a single area.

There is evidence that the field of television ultimately will include many activities beside broadcasting. The motion picture industry is working hard on its relation to television, and can be expected either to use television as a part of the theater program on large screens or to develop a large output of motion pictures suitable for television, or both. Color systems are being developed. Attention is being given to the use of television for educational purposes and also for a wide variety of business and military purposes. The telephone companies are actively cooperating in these movements and propose to be in a position to provide networks to distribute programs to groups of theaters, to provide for color, and take care of any other developments which may be brought forth.

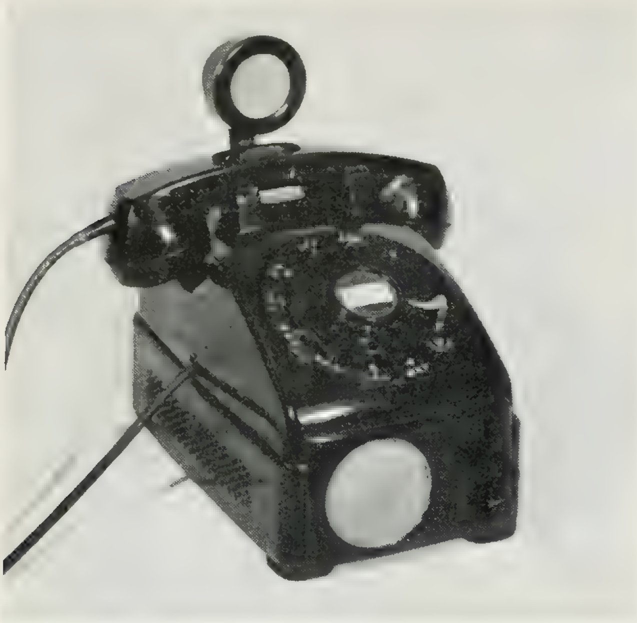
Mobile Service

THE EXPANSION of telephone service to various kinds of mobile units is another example of the development of new needs for electrical communication. A wide use is already made of telephone service to motor vehicles. Police cars, taxis, trucks, buses, and business vehicles of many kinds, totaling perhaps 250,000, now have service in one form or another. Many are private telephone systems connecting the cars with the headquarters of the organization involved. The telephone companies of the country also give a general mobile service, by which communication is established between a car and any other commercial telephone in the country. Service is now offered in 500 cities and towns to about 12,000 vehicles.

There is a rapidly growing use of radiotelephony by other kinds of mobile units. Telephony to ships, which started with ships on the high seas and along coastal waterways, is one example. Already 19,000 harbor craft and pleasure craft are equipped, including craft on rivers and lakes as well as on the oceans. General telephone service to passengers on trains is expanding, and about two dozen trains are so equipped at the present time. Telephone service is fundamental to the operational control of airplanes, and this is a private service. But in addition to this, about 350 planes have general Bell System service.

"Walkie-Talkies" practicable for short range have been developed and put to a variety of uses. It is interesting to observe that in 1940, for experimental purposes, the Bell Lab-

An answering and recording set, useful in the subscriber's absence



An experimental "distant talking" set: you would speak to it and listen to it without holding or switching anything

oratories put together a telephone set equipped with a very-short-range radio to eliminate the need for a telephone cord. You can imagine at some future time the lady of the house taking the telephone with her as she goes for a walk in the garden, and making and receiving her telephone calls there.

Auxiliaries to Telephone Service

THE EXPERIMENTAL cordless telephone set is one illustration of the fact that the development of new devices and the development of customers' needs combine to bring a continuing change in the services offered in connection with ordinary telephone usage. This is far too great a field to cover generally, but two or three illustrations of this type of development will be of interest.

For quite a long time, the telephone companies have offered, in various parts of the country, several forms of answering service; i.e., means whereby telephone calls will be answered and messages taken when the subscriber is absent. With the great improvement of automatic recording and reproducing systems, it now appears to be practicable to offer that type of service with automatic devices. The development of types of equipment suitable for this purpose is at an early stage. The experiments which we have been conducting, however, seem to indicate that this should have a field of usefulness in the future.

Looking ahead, additional auxiliary devices to meet special telephone requirements are to be expected. One example is the distant-talking set, whereby one talks and listens to a box on his desk without holding anything in his hand and without operating a switch to change from talking to listening. To provide good general service with such a device involves formidable technical difficulties, but it is to be expected that these will be overcome. Provision for conference calls has been a part of telephone service for years—that is, calls in which a group of people in various parts of the country can be connected together so that all hear what each one says. Looking forward, great improvements can be made in this service.

The inquiring mind has probably asked before this when we shall have individual television with telephone calls. Bell System people will remember the demonstration of this form of service given 25 years ago. First between 195 Broadway and the Bell Laboratories and later between New York and Washington, demonstration equipment associated with appropriate circuits enabled those conversing to see each other on television screens while they talked. In spite of the tremendous advances in television in 25 years, there is no indication as yet when this would be a sufficiently economical service to appeal generally to telephone users.

Other Needs

So far, we have talked only of the needs for electrical communication which are already before us.

The increased complexity of our industrial organization and the rapid development of new electronic devices suggest almost unlimited future possibilities for the development of new communication needs. For example, electronic devices for computation and for other uses of data suggest that the transmission of data between the parts of a widespread commercial enterprise or an industry may become an important future element of communication needs.

Similarly, the great private-line systems, some equipped with automatic switching and with means for the storage and retransmission of messages which are now in use by a few large industries, may be the harbinger of a more general requirement for special communication systems designed to meet the specific requirements of large enterprises or groups of users in the future.

In this field, to be specific would be in the realm of pure speculation. The present development of industry, however, and of the art of communication, seems to indicate that here is a trend which may be expected to be of increasing importance in future years.

Needs of Communication by Defense Agencies

It is a remarkable thing how extensive and varied are the communication requirements of the defense agencies. Some of these are—to name but a few—communication systems for the Air Defense network, both warning and control; for anti-aircraft batteries; for Civil Defense warning and administrative net-

Former President Walter S. Gifford of A. T. & T. and Dr. Herbert E. Ives of Bell Laboratories, both now retired, take part in an early-day television demonstration works; and for networks linking Army, Navy, and Air Force installations throughout the country. The telephone companies at the present time are providing private lines alone aggregating 500,000 miles of circuits. The variety and extent of use are rapidly increasing.

It is a fortunate thing for this country that the great growth of telephone communication has resulted in a vast network of telephone lines and installations throughout the country which can quickly be arranged to take care of the new defense requirements of the nation. It is also fortunate that the flexibility of the telephone system is such that a wide range of new services needed for the defense agencies can be developed and placed in operation in short order.

The Far Horizon

All of these factors—a trend to lower relative costs; the development of additional materials, devices, and facilities; and the development of needs of the telephone-using public—combine to stimulate the continued rapid growth of the telephone system. However, they would not of themselves have automatically resulted in the great growth and development which has taken place. This is also due in some part to the form of organization of the Bell Telephone group of companies.

Inscription on the Archives Building

In the Bell Telephone group are gathered together, in a closely cooperating group of companies, all of the necessary functions for giving telephone service, from the inception of an idea or birth of a need, through the stages of research, invention, development, trial, manufacture, construction, maintenance, and operation, to the rendering of the service itself. This wise form of organization gives maximum effectiveness to the initiative and resourcefulness of management and staff in expanding, developing, and strengthening the telephone service. It is a large factor in the high level of development of telephone service in this country.

It would be natural, as a result of this discussion, to ask what will be the ultimate in telephone communication. In endeavoring to look forward, it sometimes stimulates the imagination first to look back.

When my father was a baby, the most important communication system in this country consisted of a pole bearing wooden semaphore arms, located on Signal Hill on Staten Island. As ships approached New York Harbor, that approach was communicated to observers at the Merchants Exchange by the motion of the arms. The change from that system to the present situation has taken place in a little more than 100 years.

With that background, let us say that in the ultimate, whenever a baby is born anywhere in the world, he is given at birth a number which will be his telephone number for life. As soon as he can talk, he is given a watch-like device with ten little buttons on one side and a screen on the other. Thus equipped, at any time when he wishes to talk with anyone in the world, he will pull out the device and punch on the keys the number of his friend. Then, turning the device over, he will hear the voice of his friend and see his face on the screen, in color and in three dimensions. If he does not see him and hear him, he will know that the friend is dead.

Some readers may feel that this is looking ahead too far to see clearly. For the sake of such, I should like to close with a prediction which is in no sense modest, but is nevertheless very clear to see.

By the steps of the Archives Building in Washington, where are stored the treasured records of the past, is inscribed the motto, "What is Past is Prologue." A friend of mine, driving through Washington in a taxicab the other day, asked the driver, "What does that motto mean?" "Well, mister," the driver replied, "roughly speaking, it means 'You ain't seen nothing yet.' "

Without attempting to predict how closely or how rapidly we may approach the ultimate ideal which I have just described, or any of the specific steps which we have been discussing, I predict with full confidence: "Gentle Reader, you ain't seen nothing yet."

From Colliers

"*The trouble is, all the important discoveries have already been made*"

More Than 470 Years of Bell System Experience

Name	*Present Position*	*First Bell Employer*	*Year*	*First Position*
Cleo F. Craig	President, A. T. & T. Co.	Long Lines Department, A. T. & T. Co.	1913	Equipment Man
Hal S. Dumas	Executive Vice President, A. T. & T. Co.	Southern Bell Telephone & Telegraph Co.	1911	Trouble Man
George L. Best	Vice President, Business Relations, A. T. & T. Co.	New York Telephone Co.	1922	Assistant Engineer
Carroll O. Bickelhaupt	Vice President and Secretary, A. T. & T. Co.	A. T. & T. Co.	1911	Junior Engineer
William C. Bolenius	Vice President, Finance, A. T. & T. Co.	New York Telephone Co.	1921	Traffic Inspector
Stanley Bracken	President, Western Electric Co.	Western Electric Co.	1912	Student Engineer
Fred R. Kappel	Vice President, Operation and Engineering, A. T. & T. Co.	Northwestern Bell Telephone Co.	1924	Groundman
Mervin J. Kelly	President, Bell Telephone Laboratories, Inc.	Western Electric Co.	1918	Research Physicist
Henry T. Killingsworth	Vice President, A. T. & T. Co., in charge of Long Lines Department	Long Lines Department, A. T. & T. Co.	1919	Draftsman
Prescott C. Mabon	Assistant to President, A. T. & T. Co.	Southern New England Telephone Co.	1934	Copywriter
Bartlett T. Miller	Vice President, Public Relations, A. T. & T. Co.	Colorado Telephone Co.	1910	Traffic Student
Clifton W. Phalen	Vice President, Personnel Relations, A. T. & T. Co.	New York Telephone Co.	1928	Lineman
T. Brooke Price	Vice President and General Counsel, A. T. & T. Co.	A. T. & T. Co.	1934	Attorney
Charles E. Wampler	Vice President, Revenues, A. T. & T. Co.	Illinois Bell Telephone Co.	1929	Student Engineer
E. Hornsby Wasson	Vice President, A. T. & T. Co.	Southern Bell Telephone and Telegraph Co.	1926	Service Salesman

Members of American Telephone Top Management Lead Organizations Which Help Bell Operating Companies to Render the Best Possible Telephone Service

Coördinated Leadership toward A Common Objective

Judson S. Bradley

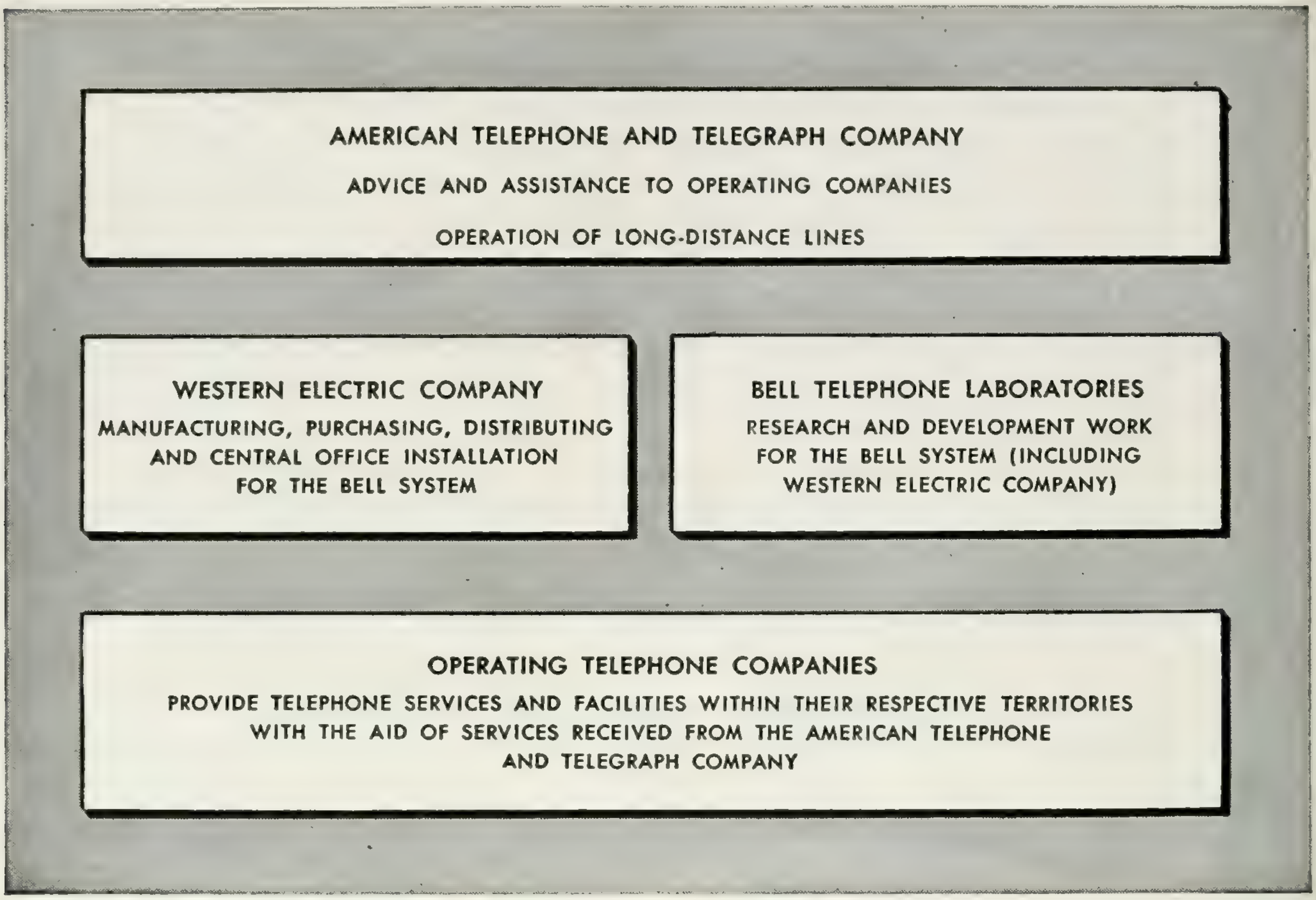
TEN O'CLOCK 'most any Monday morning finds fifteen men seated around a table in a room on the 26th floor at 195 Broadway in New York. They are the President of the American Telephone and Telegraph Company; its eleven Vice Presidents; the Assistant to President; and the Presidents of its research and manufacturing associates, Bell Telephone Laboratories and Western Electric Co.

What happens at these Monday morning meetings here is basically no different from what happens all over the territories of the System's operating companies. And like other telephone meetings, this week-to-week gathering has an important role in helping each participant to carry on his job. For all take part freely; and as each reports developments in his particular field of responsibility, all the others are brought up to date.

But there is more than information to be had at Monday's meetings. There is help when asked for: suggestions, advice, counsel, a pooling of judgment. When one of the group lays a problem before the others, it goes through the natural procedure of discussion and agreement.

And general agreement there needs to be, for the answer to one question almost never affects just one department. It is more likely to affect several or all of them. For the most part, the questions discussed are of a broad and rather basic nature; solutions to the others have already been found, so the decisions arrived at through discussion in these meetings will usually have wide influence.

Such meetings take but part of one morning a week. Consulting one another, discussing matters of common concern, seeking a fresh viewpoint—these things go on all the time. Most of the executive offices are on one floor at 195 Broadway, and it takes next to no time to drop in on a colleague in an adjoining room or across the hall.


AMERICAN TELEPHONE AND TELEGRAPH COMPANY
ADVICE AND ASSISTANCE TO OPERATING COMPANIES
OPERATION OF LONG-DISTANCE LINES
WESTERN ELECTRIC COMPANY
MANUFACTURING, PURCHASING, DISTRIBUTING AND CENTRAL OFFICE INSTALLATION FOR THE BELL SYSTEM
BELL TELEPHONE LABORATORIES
RESEARCH AND DEVELOPMENT WORK FOR THE BELL SYSTEM (INCLUDING WESTERN ELECTRIC COMPANY)
OPERATING TELEPHONE COMPANIES
PROVIDE TELEPHONE SERVICES AND FACILITIES WITHIN THEIR RESPECTIVE TERRITORIES WITH THE AID OF SERVICES RECEIVED FROM THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY

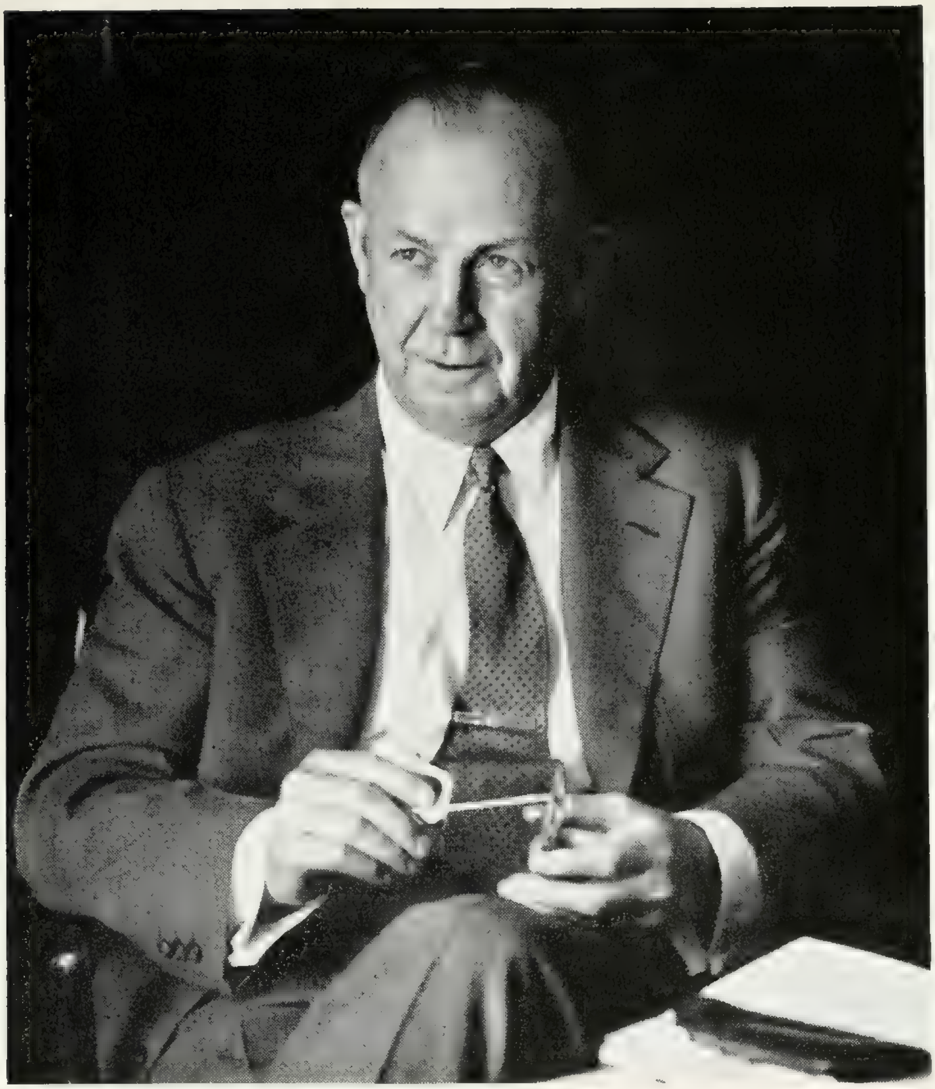
Principal Elements of the Bell System

All this adds up to a joint effort toward a common objective. What everybody is trying to do is help to render the best possible telephone service, and the particular responsibilities of A. T. & T. executives are carried out in close coöperation with their associates in all the Bell System Companies across the country.

The First Responsibility Is Local

Broadly, it works this way. The Bell System is organized on the basis that responsibility and authority for providing telephone service should function at the community level. For necessary coördination, the local operating organizations head up in 17 regional operating organizations, each with its own Board of Directors, president, and other officers, and each with the responsibility for rendering telephone service in its territory. At the same time, the regional organizations have many problems in common, so it is efficient and economical to have central groups working to help meet these problems for the benefit of all. Most of the members of the Monday morning meetings described earlier head groups of this kind. Another heads the Long Lines Department, which maintains and operates long distance telephone facilities interconnecting the territories of the regional Companies. And the Presidents of the Western Electric Company and Bell Telephone Laboratories are in charge of organizations which likewise serve the common interests of all the Companies—in the

(*Continued on page 85*)



CLEO F. CRAIG

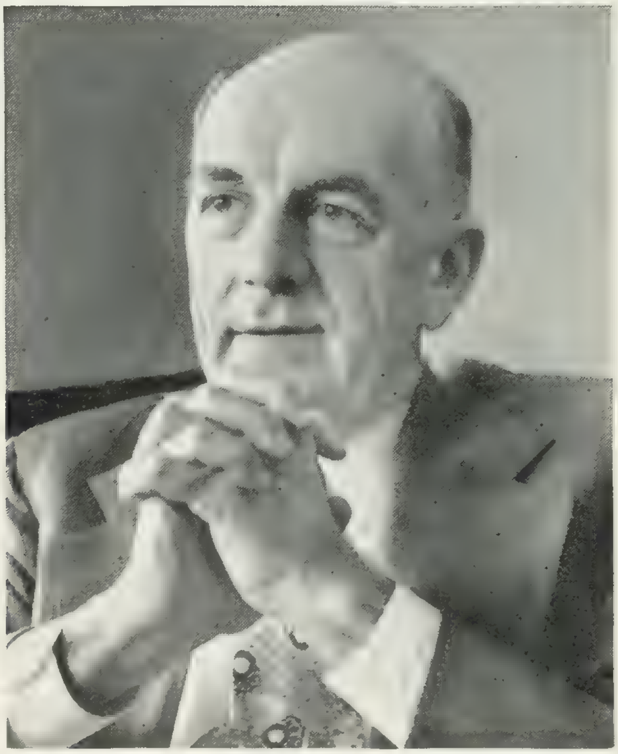
President, A. T. & T. Co.

Since July of 1951, Mr. Craig has been President of the American Telephone and Telegraph Company. His Bell System career, beginning in 1913, illustrates how broad may be a man's experience within the corporate confines of one or two companies. For his assignments in the Long Lines Department took him from St. Louis to Kansas City and Atlanta en route to New York, and to such diverse posts as district plant chief, plant accountant, and construction supervisor, among others—with a six-year interval as a special representative in the A. T. & T. General Department—before he became General Manager of Long Lines in 1933. He was elected Vice President in charge of the Long Lines Department in 1940, and the following year moved to A. T. & T. headquarters. There his vice-presidental responsibilities included, in turn, charge of the Departments concerned with Personnel Relations, Operation and Engineering, and Finance and Revenue Requirements.

HAL S. DUMAS

Executive Vice President,
A. T. & T. Co.

For forty years Hal S. Dumas devoted his life to the Southern Bell Telephone and Telegraph Company, eight of those years as President. Then, in July of 1951, he was elected Executive Vice President of A. T. & T. He started in Atlanta as a trouble man, moved to greater and greater responsibilities through the Traffic, Plant, and Executive Departments, and reached the top in 1943. Now the scene is different —and the duties too. As Executive Vice President, he assists the President in the general administration of the business, and acts for him in his absence. System executives who seek his counsel find it flavored with ripe judgment.



GEORGE L. BEST

Vice President, Business Relations,
A. T. & T. Co.

Finger-on-the-Pulse-of-Business Department might also be descriptive of Mr. Best's major responsibility, since business research and the study of new business undertakings are specifically within his charge. So are such matters as new types of telephone service, and relations with other communications services. Mr. Best joined the New York Telephone Company 30 years ago, and devoted himself to rates and other commercial matters until he transferred to A. T. & T. fifteen years later. There he was successively rate engineer, commercial engineer, and assistant vice president. He was elected Vice President of Western Electric Company in 1946, with charge of the Patent Licensing Division, and in 1948 was given responsibility for Finance. In January 1950 he rejoined A. T. & T. and assumed his present post,

CARROLL O. BICKELHAUPT

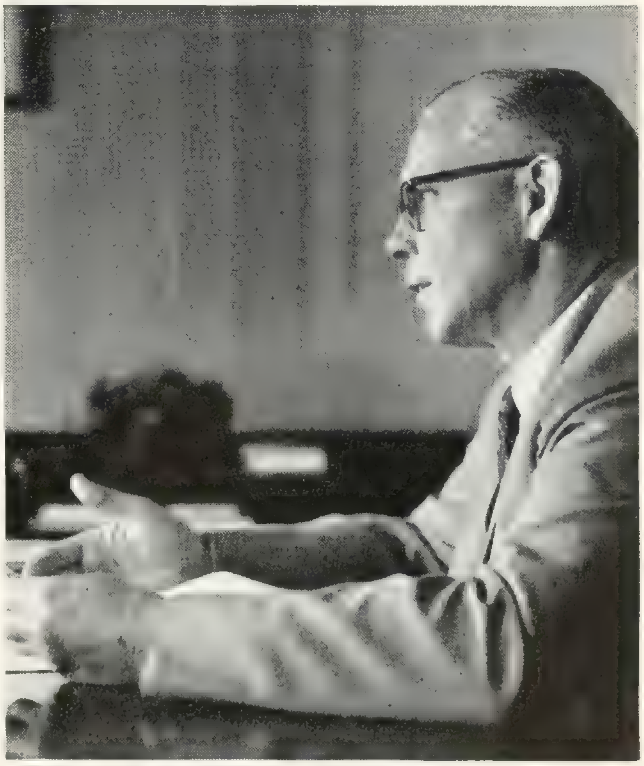
Vice President and Secretary,
A. T. & T. Co.

Mr. Bickelhaupt has had two distinguished careers: one in the telephone business—beginning with an independent telephone company—and one in the Army. With the A. T. & T. Company from 1911 to 1924, he was commercial engineer in the O. and E. Department when he was elected Operating Vice President of the Southern Bell Telephone and Telegraph Company as of January 1, 1925. After more than five years in Atlanta, he returned to New York. He was elected Vice President of A. T. & T. in 1941, and Secretary too in 1945. He was commissioned 1st Lieutenant, Signal Reserve Corps, U.S.A., in 1916 and saw service and promotions in two wars. During World War II he served as a Brigadier General overseas in a number of important communications assignments with the U. S. Forces in Europe and finally with the U. S. Military Government in Germany. He was retired from the Army Reserve in 1949.

WILLIAM C. BOLENIUS

Vice President, Finance,
A. T. & T. Co.

Twenty-two years with the New York Telephone Company, beginning in 1921, took William C. Bolenius from New York to various Upstate points, and he then became Vice President and General Manager of the Upstate Area. In 1946 he was elected Vice President and General Manager of the Wisconsin Telephone Company, and later the same year was made its President. He relinquished that post in 1948 to join A. T. & T. as Vice President in charge of Personnel Relations, and in July 1951 was appointed Vice President in charge of Finance. His responsibilities include assisting the Operating Companies with and coördinating their several financial requirements and directing both A. T. & T.'s Treasury and Comptroller's Departments.



STANLEY BRACKEN

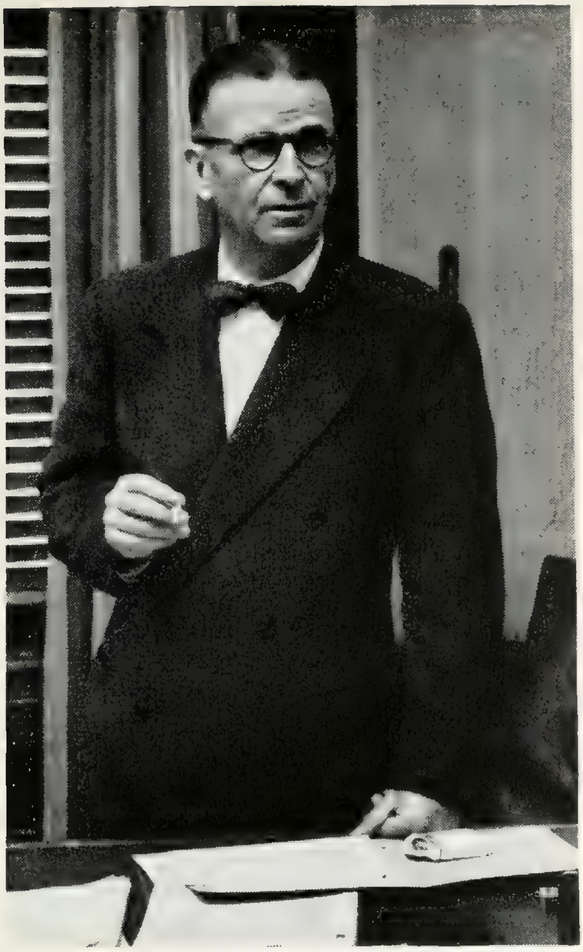
President, Western Electric Company

Stanley Bracken's fortieth service anniversary was a recent event. His entire career has been spent with the Western Electric Company, of which he has been President since 1947, and it is another illustration of how broad such experience may be. For he began as a student engineer at the Hawthorne Works in Chicago, and his steady progress brought him such assignments as three years in Japan as consultant for Sumito Electric Wire and Cable Works, and the presidency of Teletype Corporation. His election as Executive Vice President of "W. E." preceded by only a few months his election to his present office. He heads a corporation having more than 90,000 employees and plants in a dozen cities. Its greatly expanded activities now include production of much important material for the Armed Forces.

FRED R. KAPPEL

Vice President,
Operation and Engineering,
A. T. & T. Co.

"From the ground up" accurately describes Fred R. Kappel's course in the Bell System. He started as a groundman with the Northwestern Bell Telephone Company in 1924, and held a dozen positions in the Plant, Engineering, and Commercial Departments in several States before he reached Company headquarters in Omaha. There he became in turn plant operations supervisor, assistant vice president—operations, and, for half a dozen years through 1948, Vice President in Charge of Operations. He went to New York in 1949 as assistant vice president in A. T. & T.'s Department of Operation and Engineering, and in that same year became successively Vice President in charge of Long Lines and Vice President in charge of the O. & E. Department. Comprising the Plant, Traffic, Commercial, and Engineering Divisions, the O. & E. is the A. T. and T. Company's largest department.



MERVIN J. KELLY

President, Bell Telephone Laboratories

The concept of "the most service and the best" includes the provision of steadily improving equipment which contributes to economical as well as pleasing telephone service. That, in essence, is the objective to which the whole Bell Laboratories organization is devoted. Mervin J. Kelly, its head, joined the research division of the Engineering Department of Western Electric—predecessor of Bell Laboratories—in 1918. His assignments as director of vacuum tube development and as development director of transmission instruments and electronics preceded his appointment in 1936 as director of research. He became executive vice president in 1944, and, in the Spring of 1951, President of the Laboratories. When he joins the Monday morning group, he brings reports from the country's largest industrial laboratory.

HENRY T. KILLINGSWORTH

Vice President, in charge Long Lines

From Denver on the West to Atlanta and New York on the East takes in a broad expanse of territory, and Henry T. Killingsworth became familiar with a good deal of it in the course of his Long Lines Engineering and Plant assignments in the three decades between 1919 and 1949. Through it runs a path which has been followed successfully by others in the executive group, and by 1949 it had led Mr. Killingsworth to an A. T. & T. vice presidency and responsibility for the Long Lines Department. This is an operating job, and, except in the matter of financing, is like running an Operating Company. He is doubly close to the members of the Monday morning group, for all A. T. & T. vice presidents serve on the Long Lines Board.

PRESCOTT C. MABON

Assistant to President, A. T. & T. Co.

As Assistant to President, Mr. Mabon helps Mr. Craig in many ways. He assists with reports and statements, with visitors and correspondence, with information required for various meetings and with information for stockholders—and with other related matters. Mr. Mabon serves also as an assistant secretary. He joined the General Information Department of The Southern New England Telephone Company in 1934, after several years of outside employment, and became general information supervisor there the following year. He joined A. T. & T.'s Public Relations Department in 1939, was appointed information manager in 1940, and became an assistant vice president in the same department in 1944. He has been Assistant to President since early 1949.

BARTLETT T. MILLER

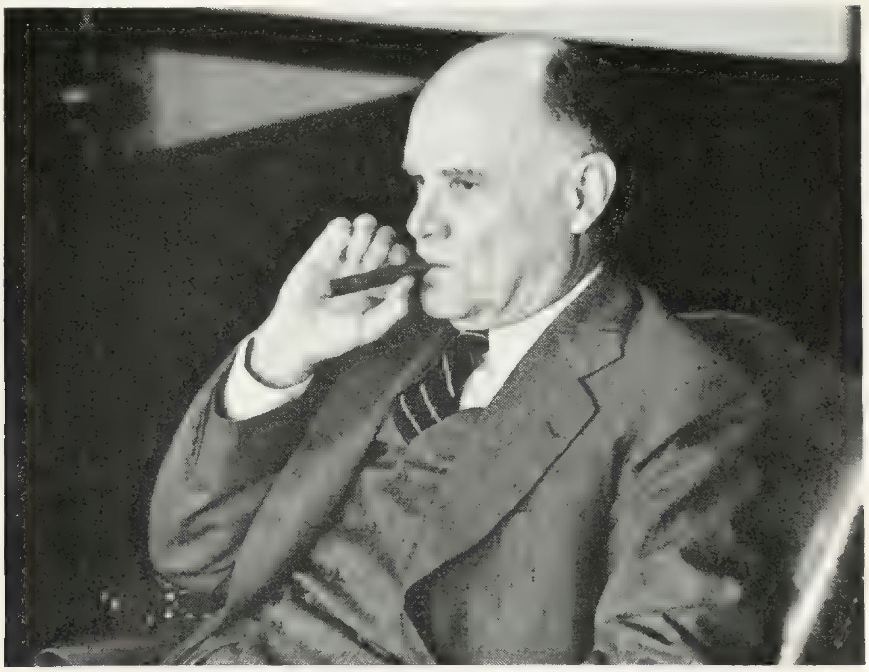
Vice President, Public Relations,
A. T. & T. Co.

Service in what is now the Mountain States Telephone and Telegraph Company between 1910 and 1923 preceded Bartlett T. Miller's move to the New England Telephone and Telegraph Company and service in various New England cities. After becoming general traffic supervisor in Boston, he was appointed Commercial Department division manager for Rhode Island, and then general commercial manager at the Company's headquarters. He was elected Vice President in charge of Public Relations in 1944, and in 1945 he became Vice President and General Manager of the New England Company. He moved to New York in 1946, where he became an assistant vice president in the O. & E. Department. The next year he was elected Vice President in charge of Long Lines. He returned to the headquarters organization in 1949, and since 1950 has been Vice President in charge of the Public Relations Department.

CLIFTON W. PHALEN

Vice President, Personnel Relations, A. T. & T. Co.

Experience as lineman, installer, splicer's helper, and in other plant crafts with the New York Telephone Company, beginning in 1928, prepared Mr. Phalen for such responsibilities as district plant superintendent at Kingston and division construction superintendent and division plant superintendent at Albany. By 1943 he had been appointed an assistant vice president in Personnel Relations, and in the two succeeding years he became in turn Vice President of that Department and Vice President in charge of Public Relations. In 1948 he was elected to similar office in the A. T. & T. Company, which he held for two years. In 1950 he became Vice President, Rates and Revenues; and since July 1951 he has been Vice President, Personnel Relations.



T. BROOKE PRICE

Vice President and General Counsel, A. T. & T. Co.

Corporate law is a highly specialized field, and requires a kind of training and experience which cannot be acquired in the telephone business. Mr. Price entered Bell System employment in 1934, and in 1936 became Vice President and General Counsel of the Western Electric Company. But he had been practicing law since 1915, and had been for many years a member of a legal firm which A. T. & T. had consulted upon occasion for ten years preceding his election. He moved from Western Electric to become A. T. & T. General Attorney in 1941, and ten years later was made Vice President and General Counsel.

CHARLES E. WAMPLER

Vice President, Revenues,
A. T. & T. Co.

Mr. Wampler's telephone career began with the Illinois Bell Company in 1929, and he became an assistant vice president in Chicago in 1948. Sandwiched into the intervening years were graduate study at M.I.T., service in Washington with WPB, and four years in the Army—which brought him duty in France and Japan. In 1949 he joined A. T. & T., and became successively an assistant vice president in A. T. & T.'s Personnel Relations Department, General Manager of the Long Lines Department, and an assistant vice president in the O. & E. Department. Early in 1951 he served with the Defense Production Board in Washington, from which he returned to become an A. T. & T. Vice President in charge of revenue requirements and studies.

E. HORNSBY WASSON

Vice President, A. T. & T. Co.

Hornsby Wasson's first regular telephone job was as a salesman of long distance telephone service for the Southern Bell Telephone and Telegraph Company in Chattanooga, Tenn., in 1926. By 1933 he had been appointed division sales manager for that State. After other responsibilities in Mississippi, Louisiana, and the Carolinas, he was made General Commercial Manager of the Company in 1947. Three years later he was elected Vice President of the Northwestern Bell Telephone Company, in charge of Public Relations. At the end of 1950 he became Vice President and General Manager of the Company's Minnesota area—the position he left on July 1, 1952, to accept an A. T. & T. Vice Presidency. His present responsibilities include advice and assistance to Bell System Companies on regulatory matters under the jurisdiction of the Federal Communications Commission, as well as matters involving the National Association of Railroad and Utility Commissioners.

(*Continued from page 76*)

one case by providing standard equipment of high quality at reasonable prices, and in the other by carrying on continuous research to develop better equipment and systems for doing a better telephone job at the lowest possible cost.

The Men Themselves

The individuals who attend the "Monday morning meetings" range in age from 44 to 63. Four are in their early sixties, seven in their fifties, and four in their forties.

More significant are the years of experience in the telephone business. Collectively, this group of 15 have had more than 470 years of experience in just about every phase of the work, from digging pole holes and collecting bills on up. Four men have had more than forty years of service apiece. The shortest period of service is more than 18 years, and the average is more than 31 years of Bell System service.

The men come from a dozen states. Four were born in the East, five in the Southeast, and six in the Mid-West. Most are from small towns.

All are married. Most have children. Six are grandparents, and the total number of grandchildren is 30.

Not all members of the group went to college. But in a business whose basic operating medium is electricity, it is not surprising that three-fifths of them have the Bachelor of Science degree. Several others have B.A. diplomas. Advanced study on the part of a few has brought the total of degrees earned up to a score, and there is a scattering of honorary degrees. The scenes of their education range alphabetically from Alabama Polytechnic Institute and Amherst to Wisconsin and Yale.

Starting at the bottom brings beginner's pay. The five members of the group who joined the Bell System before World War I earned in their first year a total sum of $3400, or an average of $680. The low was $520—$10 a week—and high was $780. The starting years range from 1910 to 1934. The average starting salary (omitting Mr. T. Brooke Price, Vice President and General Counsel, who joined the Bell System after practicing law for more than 20 years) figures out to something less than $24 per week.

There in brief you have the men who gather around the table in A. T. & T. Monday morning meetings.

Emphasis has been placed on their long experience in the telephone business, and their competitive rise from the ranks. In this business there is no substitute. But there is another side to their interests. All have accepted, and most still carry, civic and social responsibilities. Hospital boards, church groups, community chests, school committees—the list is long. Telephone people try to be good citizens and carry their share of the load.

Communication Is Two-Way

As working practice, the members of our group and the members of their respective organizations are in close and frequent contact with their associates in all the Bell System Operating Companies. Also, conferences are held from year to year and sometimes more often. The presidents of all the Companies will meet with the A. T. & T. executive group; the operating vice presidents with the A. T. & T. Vice President for Operation and Engineering and his principal division heads; the public relations officers of the Companies with the A. T. & T. Public Relations Vice President and his group; financial officers with the Financial Vice President and his group; and so on. Communication is always two-way. Ideas and suggestions flow in both directions, and this is true in the day-to-day contacts as well as in scheduled meetings. It is in this way, through give-and-take discussion, that the Companies develop their programs for action, and in this way too there are developed those basic guiding concepts which, taken together, constitute "policy."

The A. T. & T. executive group perform their functions in liaison with the Presidents of all the System Operating Companies. Incidentally, it is interesting to note that not long since, two former members of the A. T. & T. group were elected as Presidents of Operating Companies, and two who had previously served as Company Presidents accepted new posts with A. T. & T. Changes of this kind point to an important fact about Bell System leadership: that the reservoir of leadership is the entire organization, from which able executives are continually emerging.

Aiding this process are the measurements and the comparisons of the results of performance in all phases of the business made by all Bell System Companies—exchange by exchange, district by district, area by area, company by company. This helps to bring forward able men in the Operating Companies, and their opportunities are broadened as they develop the qualities needed to accept greater responsibilities. That is how the Bell System's present leaders have been developed. That is how tomorrow's leaders will be found.

United in a Common Purpose

It remains only to add that these fifteen men would be the first to tell you —and mean it—that they simply endeavor to do some forward thinking and to coördinate; that they rely on the abilities and effective teamwork of all the people in the groups they head; that it is the Operating Companies which are responsible for and furnish telephone service to the nation; and that the success of the whole nation-wide telephone system and service grows out of the spirit and skill of more than 650,000 men and women who unite in a common purpose in performing their important individual tasks.

Special Group Is Busy Writing and Revising "Bell System Practices," Operating Handbooks of which the Associated Companies Acquired a Million Copies Last Year

The Bell System's Best Sellers

A. B. Covey

THERE IS a small office building in lower New York City whose entrance is so inconspicuous that a chance observer might pass by without even noticing it. Should he enter the building, however, and proceed to the third and fourth floors, he would find himself in a beehive of telephone activity. For the two floors house a group of men from the Engineering and Plant Departments of the Bell System's Associated Companies who have accepted temporary assignment with the Operation and Engineering Department of the A. T. and T. Company. These men are engaged in the preparation and revision of urgently needed Bell System PRACTICES.

Bell System PRACTICES are the instructions which describe the best methods of engineering, installing, constructing, and maintaining the telephone plant. The engineers use the PRACTICES as guides in the design of cables, open wire lines, radio systems, carrier systems, and the many types of central office equipment. The installers use them as instructions for installing telephones, private branch exchanges, and Teletypewriter equipment. The construction forces use them in the construction of cables and open wire lines. The maintenance forces use them in the maintenance of all forms of central office and private branch exchange equipment, subscribers' station equipment, cables, and open wire lines. PRACTICES are also used for training purposes both on the job and in training schools. They are used not only in every Operating Company but also in the Western Electric Company and the Bell Telephone Laboratories.

During 1951 these Companies acquired over one million copies of the PRACTICES.

Bell System PRACTICES are, obviously, an integral part of telephone operations. They are as important working tools as any the operating forces use. Thus, they play an important part in providing the public with the best and the most telephone service at the lowest possible cost.

The preparation of such information * has been one of the major functions of the Bell System headquarters organization for almost three-quarters of a century. During that time, these instructions have grown from a few circular letters to a library of over 9,000 separate pamphlets or sections. Many times it has been necessary to call on the Operating Companies for assistance in their preparation, and now the situation has arisen again. The Companies have responded with the largest group of PRACTICE writers in history, organized since the middle of last year in the separate establishment already referred to.

The book-case contains about a third of the present active sections of Bell System Practices. They are kept in binders for convenient use

In preparing PRACTICES, those writers are following a plan established over 20 years ago. Let's take a look at some of the developments which resulted in the creation of the Bell System PRACTICES Plan, the events leading up to the organization of the present special writing group, and also a brief look at a typicial writer's job.

Early Forms of "Practices"

IN 1879, The National Bell Telephone Company was already established, with headquarters at 95 Milk Street in Boston. W. H. Forbes was president, Alexander Graham Bell was electrician, Theodore N. Vail, general manager, and Thomas A. Watson, general superintendent.

There were approximately 16,000 telephones in the country at that period, and Mr. Watson was spending most of his time trying to make them work. The subscribers of that day were not very critical of the failures of the telephone apparatus; they were amazed that it worked at all. But the difficulties experienced by the licensees, or agents, as they were called, resulted in a continual stream of questions to the National Bell in Boston on the design and maintenance of the telephone apparatus.

Answers to such questions were provided by means of circular letters, and a number of these are still preserved. It is interesting to note the

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* While the discussion here is limited to Bell System PRACTICES, information of many other types is issued by the General Departments of the A. T. & T. Company as part of the constant process of furnishing advice and assistance to the Operating Companies.

A group of "Practice" writers at work in their special quarters

general similarity between those early letters and the drawings, descriptions, and data incorporated in the present-day Bell System PRACTICES.

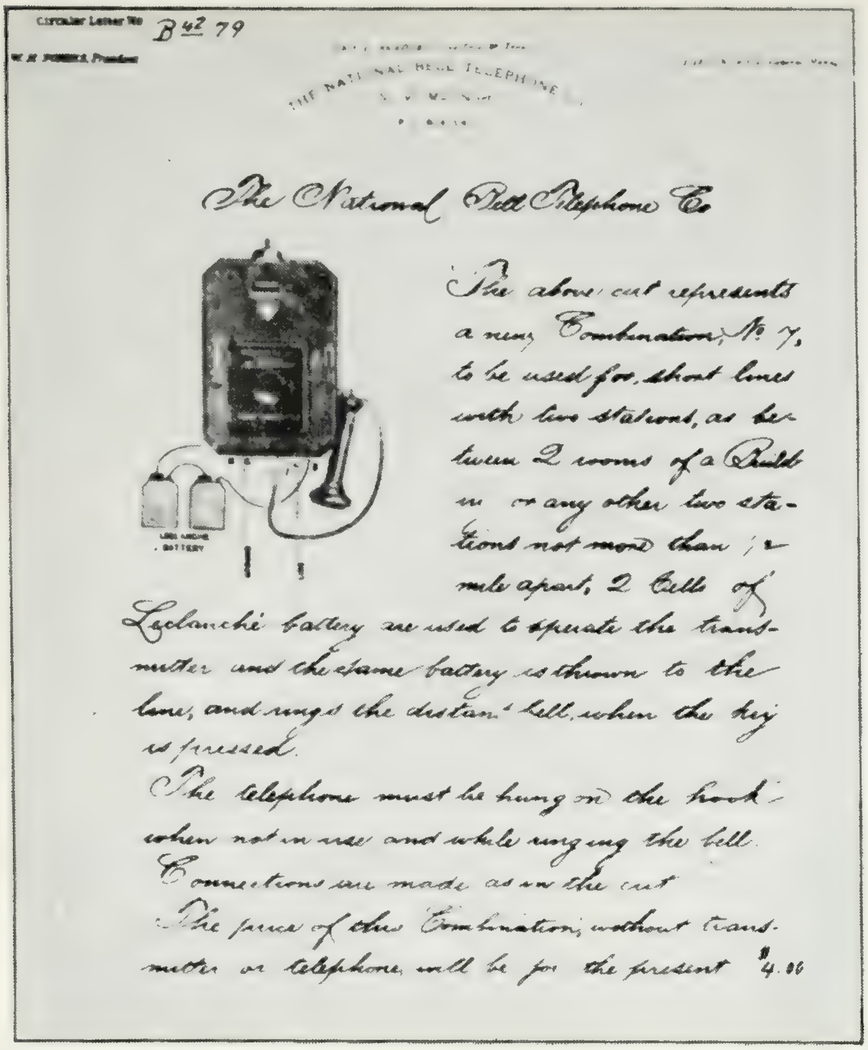
Many years later, Mr. Watson was consulted on the historical facts about the information furnished the "Operating Companies" in those early days of the telephone. The need for this kind of information could best be explained, he responded, by a trip he made through the West in 1878 to inspect the telephones that were then in use.

"My route took in Chicago, Milwaukee, Pittsburgh, Washington, and all of the larger cities on route," he said. "I found our telephones giving fairly good satisfaction to the users, although to me, when I tested them, they seemed to work badly. I was especially dissatisfied with my call bells. Both telephones and bells had evidently been neglected since they had been put into use; apparently nothing had been done to them in the way of cleaning or adjustment since they left the shop. My time on this trip was largely spent in showing our men how to adjust the instruments and impressing them with the need of constant inspection to keep them working at their best." Thus, from the start there was a real need to get into the field people's hands the necessary information on the proper maintenance of the equipment.

While not a matter of record, stories handed down from the "good old days" make it appear that standard procedures were not always followed. One tale relates to an operator who undertook to clean the switchboard plugs with steel wool. It seemed like a good idea—especially as the plugs were thoroughly cleaned. The "out" was that fine steel slivers adhered to the plugs, so that when they were inserted in the switchboard jacks they "shorted out" the jack contacts. The plug cleaning was necessarily followed by a thorough job of jack cleaning.

Another "off the record" yarn tells of an equipment attendant who was having trouble with a bay of equipment which contained a good many relays. Each morning, when he came to work, he found an accumulation of trouble reports which past experience told him were caused by "sticky" relays in the bay. Finally, he resolved to take drastic action; and each morning thereafter he hit the bay a wallop with a short length of two-by-four. The method was temporarily effective, but ultimately it was recognized as not a standard method of clearing the trouble.

Such incidents, however apocryphal they may be, do emphasize the


LECLANCHE
BATTERY

Circular Letter No B 42/79

The National Bell Telephone Co

The above cut represents a new Combination, No 7, to be used for short lines with two stations, as between 2 rooms of a Building or any other two stations not more than ½ mile apart. 2 Cells of Leclanché battery are used to operate the transmitter and the same battery is thrown to the line, and rings the distant bell, when the key is pressed.

The telephone must be hung on the hook when not in use and while ringing the bell.

Connections are made as in the cut

The price of this Combination, without transmitter or telephone will be for the present $4.00

An early "Practice," covering the No. 7 subscriber's set

place of Practices in Bell System operations.

Two important Practice developments stand out in the period up to the end of World War I.

1. *The inauguration of standard drawings as a means of furnishing information to the Operating Companies on new circuits and equipment. This method is still in use.*
2. *The introduction of the numbered specifications, covering principally outside plant construction items such as cables and open wire lines.*

Copies of some of the early drawings, dating back to the 1880s, are still preserved on microfilm at the Bell Telephone Laboratories.

The numbered specifications made possible the construction of the early open wire and cable lines. Viewed in the light of present-day standards, the methods were crude, but they filled the needs well, as is evidenced by the long periods of satisfactory service the lines rendered.

Developments after World War I

In the decade following World War I, there were more developments in the Practice situation than in any other similar period in Bell System history. In practically all of these, the Operating Companies played an important part. The developments were a direct result of concerted efforts to provide information in pamphlet form for use in the field. Those of particular interest were:

1. *Numbered Bulletins*
2. *Transmission Maintenance Practices*
3. *Handbooks of Outside Plant Engineering Practices*
4. *Transmission Practices*
5. *Bell System Maintenance Practices*
6. *Building Practices*

By 1930, Practices were being issued to the Operating Companies covering a major part of the operations carried on by the Plant and Engineering Departments. The transmission people had their method of distribution, the outside plant another method, the maintenance people still another. There was a real and obvious need for a coördinated plan of distribution. Again the Bell System team went into action: a new Bell System PRACTICES Plan was evolved. This provided for the inclusion, in one comprehensive scheme, of all instructions used by the Plant and Engineering people.

The Beginning of "Bell System Practices"

THE PLAN involved the establishment of a number of series of PRACTICES, each carrying the common title BELL SYSTEM PRACTICES. In addition, a supplementary title was assigned to each series to describe the particular type of plant and character of work involved. These titles are listed in the adjoining column.

To simplify distribution of the PRACTICES, a method was devised whereby the Western Electric Company made bulk shipments to the Operating Companies in accordance with established routines, while at the same time A. T. & T. forwarded advance copies to Company Headquarters. This general scheme is still in effect today.

The addition of PRACTICES on *plant assignment, Teletypewriter, foreign wire relations, equipment engineering, transmission engineering,* and *radio systems* followed during the next few years. The *buildings and grounds maintenance* series was changed and enlarged. By 1940, the

BELL SYSTEM PRACTICES

1. *Central office maintenance,* covering methods and procedures for maintaining central office equipment.

2. *Private branch exchange installation and maintenance.*

3. *Station installation and maintenance,* which covered both telephone and telegraph stations.

4. *Toll test room operation,* describing the operation of toll test boards and the service maintenance of all types of toll telephone and telegraph circuits and systems.

5. *Transmission testing,* relating to transmission tests generally made by traveling testing crews.

6. *Recovery and repair,* describing methods of handling and reconditioning used apparatus, equipment, and material which has been removed from the plant.

7. *Exchange test room,* covering the work associated with the local test desk, the duties of the repair service clerk, and associated routines.

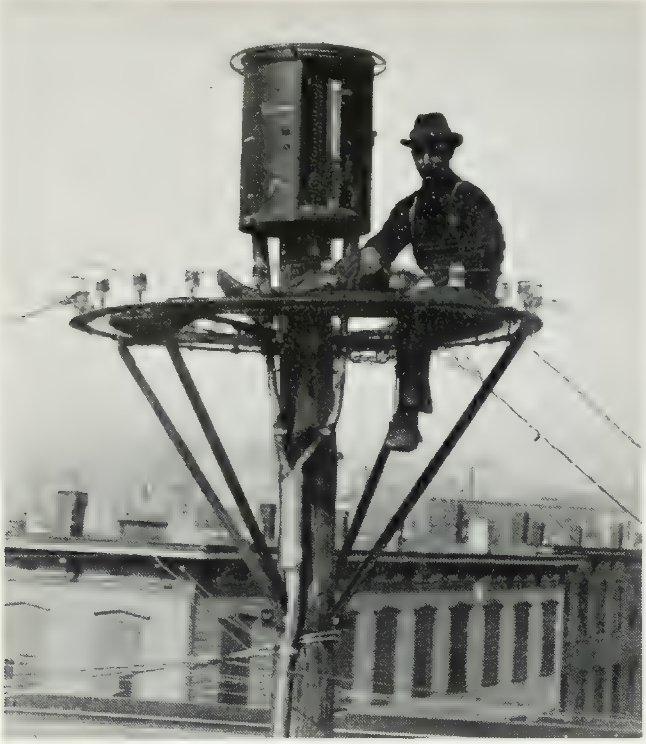
8. *Building and grounds maintenance.*

9. *Motor vehicle maintenance,* covering the care of both motor vehicles and garages.

10. *Outside plant construction and maintenance,* covering both aerial and underground outside plant.

11. *Outside plant engineering,* dealing with the structural design of pole lines, cables, and underground conduit.

(*Supplies,* planned but finally omitted.)



An example of terminal pole construction in the 1890s

Bell System PRACTICES Plan was in full swing, with instructions being issued on practically every operation carried on in the Plant and Engineering Departments.

The PRACTICE activity was much reduced during World War II and in the early post-war period because of the demands on manpower occasioned by the war effort.

Present "Practice" Activity

THE year 1949 saw Bell System PRACTICES little changed from their original form of 1930. There were many indications that they had contributed largely to improved engineering, construction, and maintenance procedures and to reduced costs. A good many more, however, were urgently needed. This was brought about by two factors:

> *Shortage of manpower for this work during and immediately following World War II.*
>
> *Large number of important developments in the period prior to and following World War II.*

System operations had undergone many changes in the years since 1930. The changes, plus the need for other instructions, raised the question as to whether the current arrangements of Bell System PRACTICES were meeting the requirements of the Operating Companies in the best possible way. To find the answer to this question, a Joint Committee, consisting of representatives of the Bell Telephone Laboratories and the Operating and Engineering Department of the A. T. and T. Company, was formed early in 1950 to review the entire matter of the preparation and distribution of Bell System PRACTICES.

The Joint Committee established a full time "working group" to assemble the facts about the situation. The group consisted of two men from the A. T. & T. Co., one man from the Bell Telephone Laboratories, and eight men borrowed from the Operating Companies. Each of the field men was selected from a different Company: four from the Plant Departments and four from the Engineering Departments. One of the important requirements was that each man should have several years' experience in some phase of System operations which is covered by one or more of the various series of PRACTICES.

The "working group" circulated a questionnaire designed to bring out the present uses and the extent of distribution of Bell System PRACTICES in each of the Operating Companies. Members of the group also made

RECOMMENDATIONS OF THE JOINT COMMITTEE

1. *Organization of the* PRACTICE-*writing work,* to bring the PRACTICES reasonably up to date and to keep pace with the developmental effort.

2. *Reduction in the number of series,* to increase effectiveness, avoid duplication, and reduce preparation effort.

3. *Changes in the style of presentation,* to make increased use of charts and other condensed and simplified methods of covering the necessary information.

4. *Inclusion in practice form initially* of much of the material now covered in general letters.

5. *Changes* in organization, numbering plan, and indexing of the PRACTICES.

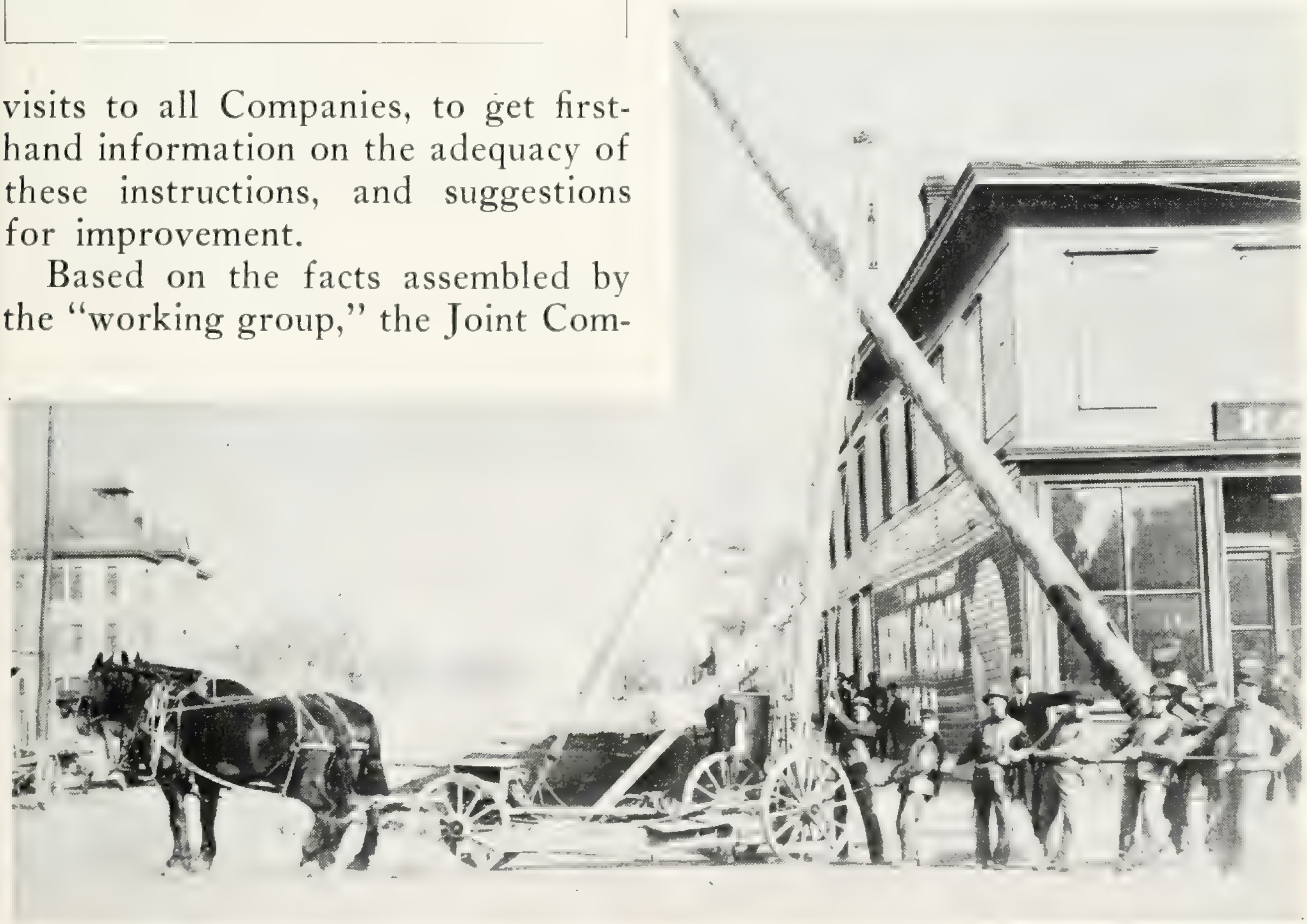
visits to all Companies, to get first-hand information on the adequacy of these instructions, and suggestions for improvement.

Based on the facts assembled by the "working group," the Joint Committee recommended certain steps as a means of making the PRACTICES more useful to the Companies. These are given in the adjacent box.

Organization of "Practice" Writing Groups

ACTIVE WORK to carry out the Joint Committee's recommendations began in the middle of 1951. The PRACTICE-writing activity at the Bell Telephone Laboratories was substantially increased. To expedite the work, 15 people from the Operating Companies and a considerable number of technical assistants were added to the development force.

A force of 65 men was borrowed from the Operating Companies to assist the Operation and Engineering Department of the A. T. & T. Co. to



An "improved method" of pole raising, for which there probably was no "Practice" bring the PRACTICES up to date. The men were selected as specially qualified from the standpoint of field experience.

The present PRACTICE writers have had experience in almost every operation of the Plant and Engineering Departments. The average Bell System service of the group is over 22 years. Practically every one of the Operating Companies is represented. History repeats itself—two of the men who were on loan to the A. T. & T. Co. as practice writers about 20 years ago are back on loan again, serving in a supervisory capacity in the group.

"Practice" Preparation: Hard Work, Perseverance, Patience

THE WRITER'S JOB starts with the need for a PRACTICE: a new development, perhaps, an improvement or change in an existing circuit, or an unusual operating condition arising in one of the Companies.

Upon receipt of his assignment, the writer proceeds to gather his basic material for the particular PRACTICE. He consults drawings, old issues of PRACTICES, general letters, posted comments from the Operating Companies in the form of engineering complaints, letters, and locally issued practices; Bell Telephone Laboratories notes; members of the A. T. & T. Headquarters staff, the Bell Telephone Laboratories, and in some cases one or more of the Operating Companies. He may also go out on a field trial of a new development, to secure first hand information.

Once the information is available, preparation of the first draft begins. At this time the writer lays plans for any illustrations required. He may decide to use only pencil sketches in the early stages, or he may feel that it is advantageous to have the Drafting Department prepare the drawings in final form.

When the writer finishes the draft of his text, copies are sent out for comments to members of the A. T. & T. Headquarters staff, the Bell Telephone Laboratories, and, in some cases, a few of the Operating Companies.

Comments are generally received from most of the people to whom copies of the PRACTICE have been sent. If the comments are minor, the writer can proceed at once to incorporate them in his draft. If major comments are involved, he must hold up the revision pending the results of a conference among the persons concerned. In the revision process, the writer usually finds that a pair of scissors and a tube of rubber cement are important tools. Coincident with the incorporation of comments, any changes required in the illustrations are made.

In reviewing the comments, the writer sometimes finds that one comment may be diametrically opposite another in its apparent intent. He must reconcile these, keeping constantly in mind that when the PRACTICE is issued, it must represent the best views of the A. T. and T. Company, the Bell Telephone Laboratories, and the Operating Companies.

Accuracy also the writer must always have before him. He realizes that a transposition of digits in the code number of a piece part may mean the difference between a very

This is the group of writers borrowed from the Associated Companies—less four who were unable to be present

small motor and a large motor-generator set. A misplaced decimal point in a Transmission Practice may result in the design of a circuit which is inoperative. The writer knows that with the wide distribution of this material, the impact of an error will be great.

After all comments have been incorporated and the copy retyped, the writer may feel that he is ready to submit the revised copy for approval. However, if some of the comments were major, he may decide to submit the copy for further check by the interested persons. In such cases, further revisions may be necessary.

Once approval is obtained, the remaining work of the writer is largely that of making sure that no errors creep in during the reproduction process.

As may be surmised, the writers have had to overcome many difficulties. But their efforts have resulted in an appreciable increase in the production of Practices; a real dent has been made in the "urgent" backlog. Furthermore, many new ideas and improvements, in line with the Joint Committee recommendations, have been introduced. Already many of the instructions prepared by the present groups of writers are in use in the Operating Companies, and the comments concerning them demonstrate that the authors are equipped with the "know-how" of Practice writing. The writers themselves are of the unanimous belief that the experience they have obtained will be of great help to them upon return to their home Companies.

The value of Practices to the Bell System, and indirectly to telephone users, has been demonstrated time and again: in normal day-to-day operations and during emergencies. Bell System Practices have played an important part in holding costs down and in helping to meet the System's objective of constant improvement in service. They are a direct result of the efforts of the entire Bell System team: design, manufacture, and operation.

On Being a Responsible Individual

Cleo F. Craig

On June 5, 1952, the honorary degree of Doctor of Laws was conferred on President Cleo F. Craig of A. T. & T. by his Alma Mater, the University of Missouri, from which he had been graduated in 1913 as a Bachelor of Science. The following paragraphs are from Mr. Craig's address to this year's graduating class. EDITOR

AS YOU take your place in your respective communities, you and your neighbors can and must determine how much responsibility and freedom you want. In the event you don't feel very courageous or competent, you will let the government—which is made up of people much like you—decide what you shall do and when and how you shall do it.

After all, if your community gives up or fails in its functions, the state will surely move in, and your influence is smaller in the state than in your town. If the state fails, the Federal Government moves in and your influence is still smaller there.

In fact, a people who form the habit of taking orders from a central government are conditioning themselves for dictatorship. What then happens is that no one except the people at the center retains any organization or authority or has kept in practice for doing anything.

Today, our communities and our country have great need for a renewed and a stronger belief in freedom for the individual. Our nation is *us*—the people of America. For our nation to stay free, we as individuals must keep ourselves free. No other people can destroy our freedom. None can maintain that freedom—but ourselves. And working at preserving our freedom means, among other things, being enough concerned with government to see that it is run honestly and with as little control over our personal and family affairs as is really necessary.

Some of the most difficult and important opportunities that you as Americans have to deal with are in this field.

IN THE FIELD of business, likewise, there is fruitfulness in freedom. Almost any organization does better when it puts all the responsibility it can on the people down the line and gives them the greatest freedom possible. In a large business, where many people are involved, it is a high art to hold to a common purpose—a common standard—and at the same time maintain freedom for those at all levels to use their brains and energies.

I could take your own future as an illustration.

If you start working in some organization and therefore under supervision, I forecast you will crave more freedom. You will complain to yourself and others of red tape, lack of imagination, and all the blunders that your bosses commit. And you will be at least partially right; for in spite of diligent efforts toward decentralization in recent years, management in general has a long way to go in this difficult direction. There is great opportunity here, and I hope that as you progress and occupy seats of authority, you will remember your own complaints and see if you can improve the lot of the youngsters who follow you.

AND MAY I make another comment? On the average, you will be fit for promotion before you get it. Fitness often has to be demonstrated in a number of ways and to more than one individual. That takes a little time.

Also, when you are ready and capable of moving up, there must be a place to move to—or you can't move. However, if you are really good promotable material, such periods when you seem to be standing still will be short, and you can help to shorten them even more by continuing to do the job at hand so well that you become the logical candidate for a move.

It isn't your standing or rank at any one moment that counts. It's what you do in your job. Will you give it your best and keep on giving in spite of everything?

If you will, the difficulties will only stimulate you—not discourage. You will grow strong from your troubles. You will create for yourself unlimited opportunity. And that is true in business, agriculture, education, or any of the professions or other pursuits for which you have been preparing yourselves. . . .

One further thought that I will just mention: The way responsibilities have to be divided these days, many of you will be doing rather specialized work. In producing more goods and new kinds of goods, the specialist has a very important part to play. He can play it best, however, if at the same time he keeps his angle of vision wide.

HOW USEFUL some of you may be in a particular line of work depends on whether you keep your ideas wider than your specialty—on how well you can see the meaning of what you are doing in relation to the work of others.

You remember it was said of St. Francis of Assisi that one day when he was hoeing in his garden, someone asked him what he would do if he knew he would die at the end of the day.

He answered that he would finish hoeing the garden.

The meaning of that to me is that he had a clear understanding of the relation between what he was doing and all the rest of life. His thought traveled farther than the handle of the hoe.

He also knew that the way he looked after his own little patch of ground was important. And it's just as important to you as it was to him.

THE more highly organized our society becomes, the more our activities are joint with other men and women, the more we depend on each other. But we can only depend on each other if individually we set worth-while goals. No group of people can advance except as individuals in the group grow and develop.

How does a responsible individual grow? What is the kind of thinking that guides him? And how does he measure his growth?

I think first he tries to keep in mind that the real measure of all his effort is not what he gets in material things but rather what he becomes. It is what he becomes—and keeps on becoming—that determines his influence and effect on the lives of other people. And he realizes that only as he can influence others for good, will he truly accomplish anything.

The process he follows is pretty much a process of taking on larger responsibilities in exchange for smaller ones. And he makes his influence felt largely by example. By excellence of workmanship—how he cares for his own patch of ground. By willingness to do the hard jobs. By giving his fellow-men and women an extra something of value. Thus by his own actions he makes it easier for the neighbors to do likewise.

The world is so big, and so full of machinery, that you may think it somewhat overpowering.

But don't let size and machinery dismay you.

Everything worth while still begins with a human being—with a person just like you. The progress of a country comes not so much from mass action as from individual improvement.

THE WARS and the trials that have been shaking the world have cost us much here in America. They have left us with less liberty than before, and our opportunities are more difficult, perhaps, than they used to be. Regardless of where or how these matters begin, they are costly to everyone.

But there is no necessity for the loss to be permanent. The remedy —and I repeat—is within the individual: within you.

As to the outcome, I am strongly optimistic. . . .

You who are graduating have a great heritage.

I know you will cherish it and make your own important contributions to it—that you will build it even stronger.

And so I have complete faith that you and Americans like you will fortify your determination to remain free men and women; that there will be courage in full measure to defeat the threats we face. . . .

Memorial Day Ceremonies at A. T. & T. Headquarters Honor Bell System Men and Women In Two Wars

Ceremonies observing Memorial Day were held on May 29 before the commemorative plaque in the lobby of the American Telephone and Telegraph Company building at 195 Broadway in New York City. They were conducted by Bell Telephone Post 497 on behalf of all Telephone Posts of the American Legion, since the plaque commemorates the sacrifices of all Bell System employees who served in two wars.

President Cleo F. Craig of A. T. & T. and Mr. J. J. Morrow, Commander of the Legion Post, placed a wreath at the base of the bronze memorial tablet. This was followed by a moment's silence and the sounding of Taps.

Before the placing of the wreath, Mr. Craig spoke briefly of the significance of the gathering, which numbered some two thousand telephone people. They had come together, he said, "to pay tribute to our fellow men and women of the Bell System.

"The plaque which commemorates their service and sacrifice was erected to be a constant reminder of our pride in them and of our gratitude to them. It reads:

> *" 'In lasting memory of one thousand seven hundred and sixteen Bell System employees who gave their lives for their country in two world wars and in honor of all of the ninety-four thousand eight hundred and forty-seven who served.'*

"To these we now add, and remember in our thoughts and prayers, sixty-three who have given their lives since the conflict in Korea began and sixteen thousand eight hundred now with the colors.

"As citizens and as members of the Bell System, we are all in the service of the nation.

"May we draw courage from the memory of those we honor, and may our prayers for them renew our faith and strength to accomplish the tasks that are ours."

Last Remaining Sections of Veteran New York-Washington and New York-Chicago Circuits Will Follow Philadelphia-Chicago Line into Oblivion Before Long

Noted Old LD Lines Are Finally Retiring

Richmond B. Williams

Note: Something of the high adventure of America's pioneering days still persisted when the early long distance telephone lines were built, half a century and more ago. The news that the remaining sections of three of these old lines were about to vanish evoked in some of the men who worked on them recollections of those undertakings and of a period when the blacksmith and the twenty-five cent dinner were still honored members of the American community. The following article is based on the responses of some 70 telephone men to requests for first-hand information about this trio of yester-year's lines. R.B.W.

As TELEPHONE HISTORY lengthens, and new facilities, such as radio relay, come upon the communication scene, the veteran plant of yesterday gradually disappears. For some time, only short sections of the pioneer New York-Washington, New York-Chicago, and Philadelphia-Chicago open-wire lines have been in service. And recently even these spans have been dismantled or are scheduled to go ere long.

These old lines did more than expand the sphere of long distance telephony. As they made their difficult way across rocky fields, swamps, rivers, forests, and mountains, these lines provided all the classic problems to test the stamina and ingenuity of construction forces and those charged with maintaining that comparative unknown—a very long telephone circuit. They also were periodically rebuilt to some degree as new types of equipment—loading coils, for instance, and later repeaters—were developed for better transmission. Again, they carried some of the first private line services for financial houses and the press; and

The men and equipment under Foreman J. O. Murphy line up for a photographer (atop a building in the fair grounds at Ridgeway, Pa.) to show what the well-set-up construction gang looked like in 1896

much early carrier telephone and telegraph development work was performed over their spans of copper.

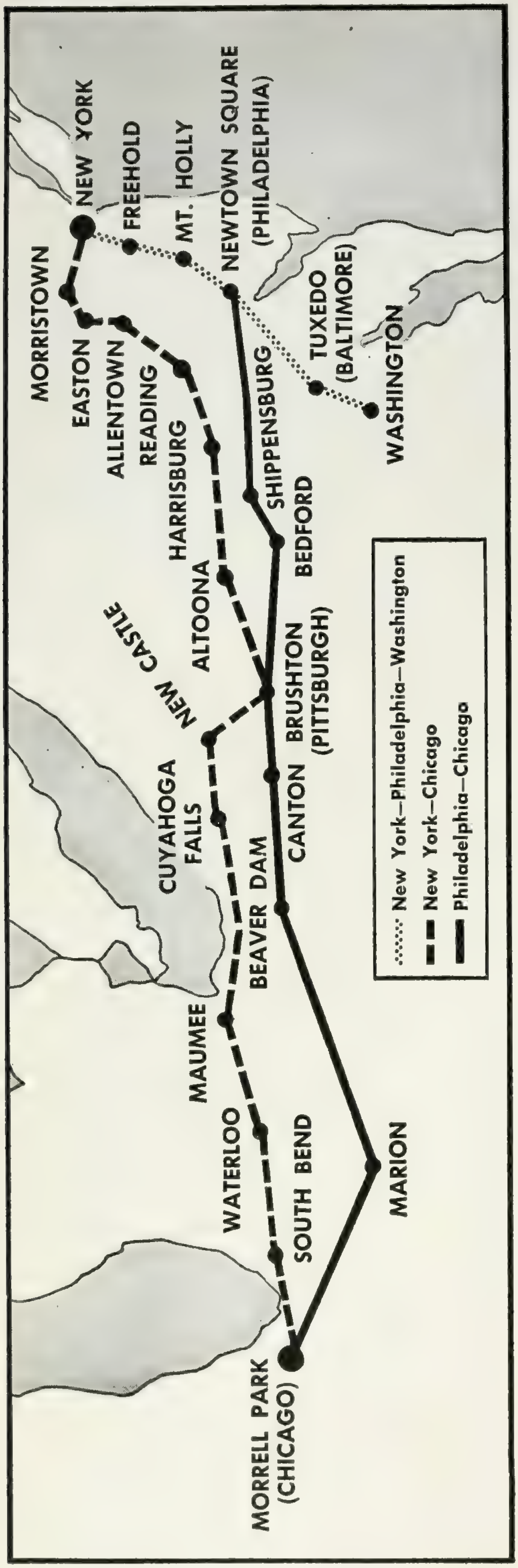
These vanishing lines touched a number of offices which in themselves have become centers of telephone history. What old timer, for example, hasn't recollections of Newtown Square and Brushton, Pa.; of Maumee, Ohio; and of Morrell Park, joined to Chicago by a "bob tail" street car?

Over the years many sections of these pioneer lines have been disposed of. However, such action by no means spells any waste of valuable materials. Sometimes, after finishing its long distance role, a section may merely change function and become part of local or regional telephone facilities. Or the re-usable poles, cross arms, and hardware may find their way back into telephone plant at other places. Significantly, in these critical times, copper wire and other metals will be re-smelted as usual for immediate re-use for vital communications purposes. Finally, a fragment may form a souvenir, cherished by a telephone man for its associations.

New York to Washington

THE New York-Washington line, a real A. T. & T. Company pioneer, started out as the New York-Philadelphia line, which was built between August 1885 and April 1886. Between April and November 1889, it was extended to the national capital, and its name was changed accordingly. To handle increased traffic, the original section between New York and Philadelphia was supplemented by a second line, built between July 1900 and May 1901.

The first section was made up of about an equal number of cedar and pine poles, originally 45 feet tall but



Left: One of these three historic old telephone lines is no more, and the other two are due to follow it into oblivion

later shortened to a little over 30 feet. It carried 24 copper wires, and a so-called iron "zero" wire as well, affixed to the top of the poles. This addition, thought to add to the stability of the line, was later used as a grounded telegraph circuit. In those days, incidentally, the present system of referring to the size of wires by their diameter in mils was not followed. The records mention Nos. 12, 14, and 16 gauge. The first was the strongest. Later the even stronger No. 8 gauge was also employed.*

The second section—between Philadelphia and Washington—had about four cedar poles to every pine pole. Originally 40 feet tall, they too were cut down to the same height. At first only ten copper wires and the iron zero were stretched on this part of the line. The remaining span of the original New York-Washington line, still standing between Mount Holly and Camden, N. J., is due to be dismantled this Fall.

New York to Chicago

THE LINE between New York and Chicago was built in eight sections, to be ready for the famous World's Fair held in 1893 on the shores of

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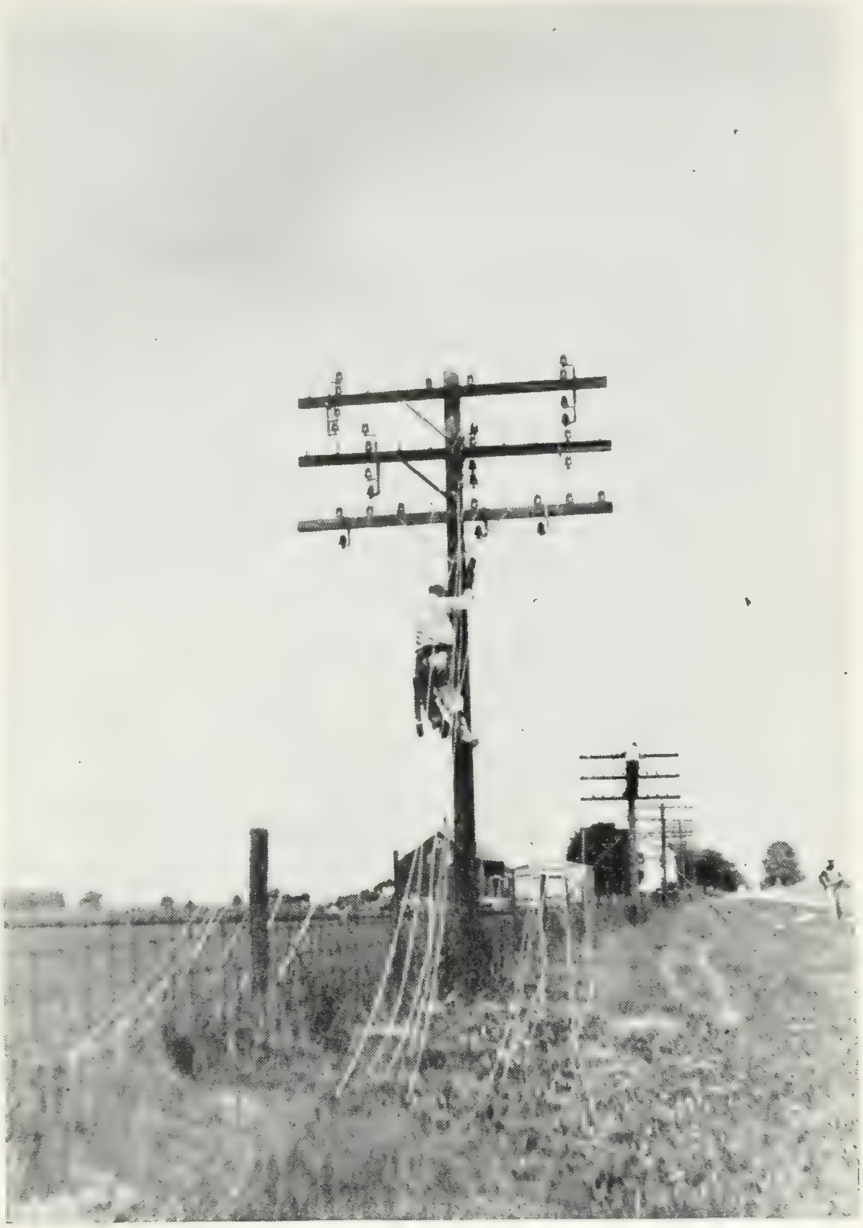
* This, a size in Birmingham Wire Gauge, was generally used for iron wire, but Long Lines used it for copper wire. Its diameter is .165 mils. No. 12 (New British Standard) is .104 mils. Cable conductors then as now were ordinarily coded according to the American Wire Gauge, which is identical with the Brown & Sharpe Gauge.

Lake Michigan. The eastern portion, originally known as the Pennsylvania Central Line, was begun in November 1889 in Jersey City and was completed to Pittsburgh in October 1891. It was almost entirely composed of 35-foot cedar poles, later cut back to about 30 feet, and its various sections carried between six and ten copper wires as well as the iron zero wire.

The western portion, begun in February 1891, was finished in October 1892, when it reached a point one mile west of Hammond, Ind. Here it was connected with the A. T. & T. Company's Chicago-Blue Island line, which had been built between January and July in 1889, in anticipation of the construction of the line extending westward from New York.



Goodbye to an old timer: the last section of the original Philadelphia–Chicago line, from Marion to Logansport, Ind., was dismantled last October

Cedar poles varying in height between 40 and 45 feet were used on the western portion of the New York-Chicago line, but ultimately they too were leveled off at about 30 feet. This portion also carried between six and ten copper wires and the familiar iron zero. The remaining link of this pioneer line—between Maumee, O., and South Bend, Ind.—is slated for later dismantling.

Extension of telephone circuits was, no doubt, in line with the report by A. T. & T. President Howard Stockton, in March of 1888, that "The income from the long lines is now more than sufficient to meet the current expenses, and there is every reason to expect that before next year it will pay a moderate profit." In the same report he stated, in speaking of the lines between New York, Albany, and Boston, that their "success electrically, as well as commercially, has been beyond our expectation." Perhaps this was because, as early as March, 1885, a report of the predecessor American Bell Telephone Company confidently stated: "Conversation can readily be carried on in low tones, the speaker's voice being easily recognized." All of which augured well for the new long lines.

A telephone executive of today remarks that, to a considerable extent, the success of these old long distance lines was due to acknowledged high standards of construction and maintenance. "The lines were clear of trees, sagging wires, broken insulators, and similar faults," he points out. "There is no question but that these factors had an enormous part in our reputation for good service, built up in the days when competing forces were actively at work."

Philadelphia to Chicago

The third old timer, the line between Philadelphia and Chicago, was constructed as one project between April and December 1901. From Newtown Square, outside of the Quaker City, its 35-foot chestnut poles carried twenty copper wires as far as the test station at Dallastown, Pa., 60 miles to the west. Beyond that, only ten copper wires ran on 30-foot chestnut poles into Brushton, outside of Pittsburgh, which was reached in July. From here the same number of wires was carried on cedar poles of similar height into Morrell Park, the test and operating station outside of Chicago. By this time the iron zero wire was no longer used.

The last remaining section of the original Philadelphia-Chicago line—

Down by the Pennsylvania Railroad tracks in Baltimore, this gang paused to let the photographer record the fact that poles were really long at the turn of the century from Marion to Logansport, Ind. — was dismantled last October.

A line crew at Hazelton, Pa., in 1910, all set for a big day's work-out

Good Old Days

THE neat reports of the Engineer's Department in New York, kept in black binders stamped in gold, reveal many details about these lines and include items unfamiliar to present-day accountants. Usually typed, but often in fine handwriting, they lay bare the anatomy of a horse-and-buggy era in telephony.

The team and driver so important to such enterprises then were usually hired, it seems, for $65 a month. There were entries as well for the "reel wagon," the "board hunter," the "dinner wagon and driver" and for shoeing many a horse. Gang leaders were ordinarily paid $35 and board a month and their men $30 and board a month—for the standard ten-hour day, six-day week, of course. Not to mention the frequent and very unstandard stretch of hours during which devoted men in a pioneer industry struggled to get the line across rocky soil, over the river, and up the hill.

Stout Fellows

"FOUR MONTHS out of the year we started out before daylight in order to be on the job at 7 A.M. Then we worked until 6 P.M. and came in after dark. That was known as the good old days," writes one member of a gang of yesteryear.

"In many ways the foreman of an early wire gang was like the skipper of an old-time sailing vessel," writes a retired employee. "Both have gone out now, but the point is: they successfully met the conditions they were up against. It must be borne in mind that [the foremen] had to rule over as hard boiled a lot of men as was ever gathered together. They could control their gangs only by being tougher, braver, more reckless, and withal better fellows than any of the men under them."

Another writer also testifies to the rough qualities of the men but adds, "Many of them would get down on their knees and make a little prayer beside their beds at night."

The brawny men who worked so indefatigably played hard too. Whenever a group of pioneers gets together there is many a chuckle over the pranks they played on each other, the horse shoes they pitched, the poker they played over the week-ends, and the dances they occasionally found in the quiet little towns along the lines. A good uppercut relieved tension once in a while, and in some territory there was fishing and hunting and even the rarer sport of shooting rattlesnakes. The cup that cheers had its devotees too—which prompts one telephone man to characterize a particular driver as the "only fellow I ever knew who could tell from the color of a farm house and its general surroundings whether they had any hard cider in the cellar. He was seldom wrong."

Despite such occasional shenanigans, the telephone men enjoyed an excellent reputation where they worked or were stationed along the lines. "Often, when we turned up to do a job the local farmers would not allow us on their property until they were sure that it was all right with Bob X—," writes one of the ex-members of a gang. "Bob, the section lineman, was the Telephone Company in person and nothing could be done unless it was all right with him." Another states: "The children would say with great respect, 'That's Fred Y—'s line'!"

Before Earth Borers Appeared

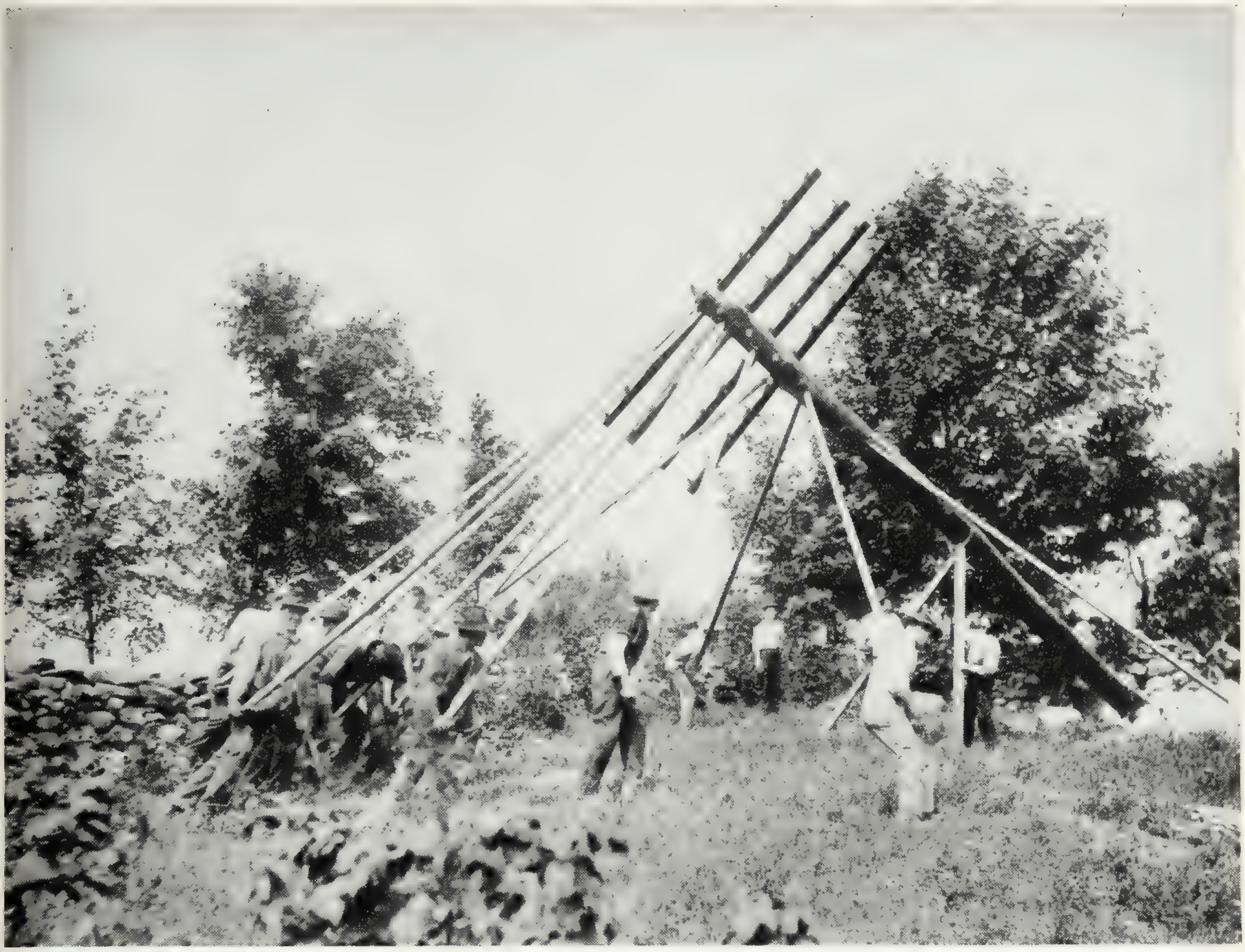
Every note or conversation highlights the exhausting, back-breaking labor pole-hole digging and pole setting meant before the day of modern equipment. Also, rivalry was keen—and a word of praise long remembered. One of the men still recalls an incident which occurred when he was working at Oxford, Pa., on the Philadelphia-Chicago line.

One day A. S. Campbell, Construction Superintendent of the A. T. & T. Company, and Walter E. Ainsworth, his assistant, "happened by just as I had my hole down about five feet, with my rocks in one pile and the dirt in another," he remembers. The visitors observed his use of the spoon shovel and, as they went off, Mr. Campbell remarked, "Walter, there's a mighty good hole-digger." The glow of pleasure called forth by that remark was unforgotten fifty years later.

Another writer tells of watching the New York-Chicago line being built in 1889 through Mifflintown, in Juniata County, Pennsylvania, before he worked for the company. "Many of the poles were 50 feet in length and it was a marvel how the job was handled. Every man had a certain thing to do and knew just how to do it. I have my doubts that a gang of men like that could be gathered today to work together as they did." The tools might be on the primitive side, observes a retired executive, but the skill and spirit of the men left nothing to be desired.

Perhaps it was the difficulty of raising these wooden giants, together with the task of affixing a battery of cross-arms to them, which made each pole a separate personality to the men who reared and cared for them. Recent correspondence and older files devoted to these lines fairly bristle with the designation of poles by number, and it is obvious that these usually impersonal digits clearly suggest the faces of old friends—or enemies—whose appearance and surroundings are completely familiar.

Aside from so much hand labor, a deterrent to speedy construction in those days—and ultimately to quick trouble clearing—was the state of the roads. "Owing to the extreme bad condition of roads in this sec-



Although the gang evidently raised this 40-foot pole successfully, scarcely a man is piking in accordance with later and safer methods

tion [in Pennsylvania near Brushton] the work is progressing slowly," ends one construction report which could do for many a similar project. None too good in the best of weather, the roads became quagmires on wet days and wagons sank up to their hubs in red clay "gumbo." Construction forces which had to transport poles ranging from 40 to 90 feet in length had their work cut out for them under such conditions—even before they started raising the giants with few aids to muscle-power.

Pride in the Work

THE MEN recently involved in constructing the first coast-to-coast radio relay route will have no difficulty in appreciating the pride of those who worked to open pioneer lines in the past. Long after the facilities had become part of the plant, those concerned delighted in telling of their roles in the enterprises. In fact, a retired engineer remarked, they were not always exactly modest in such descriptions.

When this engineer was wire chief at Harrisburg, Pa., one of the general foremen dropped in and in the course of conversation casually remarked, "When I built the New York-Chicago line through Harrisburg. . . ." His host was greatly impressed until another foreman, passing through the city later on, made a similar observation. This prompted the wire chief to turn to his boss and express his wonderment. The latter smiled and replied, "Well, it probably required several foremen to build the New York-Chicago line."

About a month afterward, his boss said, "The man who built the New York-Chicago line will be here tomorrow." The next day brought in Mr. Campbell, but in the course of an hour's talk about telephone matters he said never a word about building the New York-Chicago line through Harrisburg or anywhere else.

In the early days, the right-of-way man was more often a gang foreman than a lawyer. Most of them were appreciative of the importance of making a good impression on the public but, faced with the need of pushing the line through, some of them were not overly concerned with niceties—as the maintenance people discovered later. Occasionally, construction forces worked with thoughts of the arrival of the sheriff in their minds, and irate owners stood in newly dug pole-holes or took shotguns in hand while discussing property rights. Money was not exactly squandered by the advance agents either—to judge by many a grant through an entire property for $1.00,

A line gang, with mascot, sits for its photograph on a peaceful Sunday afternoon forty-two years ago. It will be noted that quite a few derbies were being worn then in Pimlico, Md.

or the practice of one foreman who secured a number of property rights along the New York-Chicago line for "a quarter" each.

As telephony took on a more solid footing, real live accountants were hired to take up some of the work. This had its compensations, as one foreman of a construction gang found when he complained to his supervisor that it was impossible to get his accounts straight because there was always a mistake in addition. He was told to stick to his last and not worry about such details. If he chose, he could send the accounts in a basket to those accounting boys at the office and they would take care of the rest.

The exterior of the test station at Newtown Square, Pa., outside of Philadelphia, seen in 1901—in the heyday of the cross-arm

The Old Stations

Many of the reminiscences about the old days and the old lines center about certain test and operating offices which played typical or leading parts in telephone development. Their missions fulfilled, many have since been discarded.

Such was the office at Newtown Square, Pa., on two of the routes under consideration here. Originally a frame house which was the home as well as office of a section lineman, it later became a neat red brick building. Partly because of the name of the town, and partly because of the many important lines known to converge there, most visitors reached the place with the idea that they would find some imposing civic center. Confronted with such a homey scene, they inevitably inquired, "Where is the square?"

However, that homey touch underlay the formation of a celebrated volunteer fire company, enthusiastically supported by the telephone crowd and a fierce competitor for honors in the trials held among the fire companies of Delaware County. The organization was founded before World War I when a bad fire annealed all wires on the Philadelphia-Chicago line and threatened to spread to various buildings in the town.

Brushton, outside of Pittsburgh, on both the old lines running to Chicago, was another such focal point. It too began in a frame building occupied by a section lineman and his wife, who did the operating. In 1901 Brushton was distinguished by a boss who arrived daily by bicycle after a three and one-half mile trip. Another of its distinctions was the adoption in 1910 of a high-wheeled truck, the first motor vehicle for section lineman use.

The ivy-covered station was often the scene of important experiments in telephony. Here the engineers made a number of tests at night on large gauge wires and the effects of loading them. Brushton was also one of the first repeater stations on the initial transcontinental line. Great was the interest in the first mechanical repeater installed there —and the vacuum tube repeater which ultimately replaced it.

Finally, the first experimental field testing work involving carrier systems took place at Brushton in 1916. In the fall of 1918 the first carrier telephone systems went into commercial operation between Brushton and the Tuxedo station in Baltimore.

Because of the many long-haul circuits to the west and south and the number of leased private telegraph wire services which passed through the station, its personnel was everlastingly busy testing and locating the troubles inherent in the early plant. During sleet storms it was often the haven for line and cable forces as well as "inspectors" (now equipment attendants) pressed into service in emergencies—all of whom could count on a cordial greeting and a good cup of coffee there before starting on their way again.

When it was opened in 1892, the station at Maumee, Ohio, was also the cottage home of a section lineman, who helped to build the New York-Chicago line, and his wife, who acted as operator and helped occasionally at the one-panel testboard. At the height of its activities, there were 40 employees at Maumee and a number of those who worked there became important figures in the Bell System.

In 1916 and 1917 this station was involved in field trials of carrier telephone systems over Long Lines circuits to South Bend. In 1917 and 1918 the circuits between Maumee and Morrell Park, on the edge of Chicago, were used for experiments with carrier telegraph service.

Pole 11040, a Long Lines landmark beside the Maumee office and the last survivor of the original New York-Chicago line, was taken down because of a street lighting project several months ago. For sixty years this sturdy veteran had raised its cross-arms—at one time as many as twenty-four—in this Ohio town rich in telephone lore. Now, sections of the pole are to be found in the museums of the Bell Telephone Laboratories and the Ohio Bell Telephone Company as well as in the homes of several telephone pioneers.

Largest in the World

Established in 1896 and reputedly at one time the largest open wire terminal in the world, Morrell Park, the test and operating station at Chicago, played its part in the business and anecdotage of telephony for 55 years. Across a sparsely-settled area outside of Chicago could be seen poles with multiple cross-arms bringing lines from many cities. This great convergence of open wire created quite a problem for a station which for a long time was equipped with only one volt-milammeter, one wheatstone bridge, and one log book related to clearing troubles.

These were the days when there were only three or four houses in sight and each summer an encampment of gypsies settled down about a mile away. It was also the period when the station possessed a night boy endowed with overpowering curiosity. One evening he investigated the power board to such effect that the next morning, as one of the operators put it, "we were in a terrible condition."

For some time after the opening of the long distance lines eastward, the telephone booths at the Quincy Street office within Chicago were busier offering exhibition calls than in collecting money for paid-up business. Often a cab would be sent to bring a prospective patron to the telephone office, where he was allowed a free call to a friend on the shores of the Atlantic in the hope that he might take up the new idea and telephone out of town often. After service was opened as far west as Omaha in 1897, everyone was extremely proud of the fact that the Cudahy Packing Company actually put in a long distance call *every day* from Boston to the Nebraska point. A company leaflet made quite a point of the matter.

The railroad guide at the Morrell Park station was well-thumbed. For gangs and individual linemen were often dispatched by train to points where teams and drivers could take them to a trouble spot. If the roads became too difficult for a team, the linemen would then resort to horseback. One enterprising chief testboard man at the Illinois station once engaged an auto for clearing trouble, but dropped the scheme when the livery man submitted a bill for $5.00 an hour.

Those Were the Days

IN THOSE DAYS a lineman who was as much as fifteen miles away from home at nightfall would plan to stay overnight at a farmhouse or an inn.

"The meals were good" is the unanimous report—and the prices a joy to recollect in this era. Room and three meals a day ranged in price from 75¢ to $1.00, although an occasional bargain at 60¢ could be found. Naturally, the dollar top was ordinarily reserved for some special place in a large town. In the Chicago territory, incidentally, the accepted price

The interior of the test station at Newtown Square, in 1912. This station was on both the New York–Philadelphia–Washington route and the line from Philadelphia to Chicago was 20¢ for each meal and 20¢ for overnight—total 80¢. It took an emergency or a special situation to justify $1.00.

Dinner was usually a quarter, although one rather high class place was noted for charging 30¢. To be sure, one company account book shows that in 1902 a lineman and his driver each actually spent 40¢ for dinner along the Philadelphia-Chicago line. The pair did better in providing their horse with an evening meal for 15¢, which also gave free stabling, of course.

Meals were served country style, with all food on the table so that you could help yourself. A good breakfast meant ham and eggs, bacon, sausage, home fried potatoes, buttered toast, coffee, and occasionally even pie and cake. Dinner wasn't so niggardly—you got soup, two or three kinds of meat, potatoes, vegetables, homemade bread, cookies, various cakes, and coffee.

Beds, on the other hand, were not always good. Also, if those arriving early had been assigned to all the beds, late comers had to be content with a "shakedown," a tick with straw or corn husks laid on the floor.

Hard Going

THE COMBINATION of open wire lines, sleet, wind, cold, and the bad roads of former days often made maintenance exceedingly difficult for the plant people. "We were always glad when the storm season—from about November 15 to April 15—had passed." Even where No. 12 gauge wire had given way to the stronger No. 8 gauge and the poles were storm-guyed and so closely spaced that they looked like "hog-tight and bull-strong" fences instead of telephone lines, the problem was still extremely troublesome.

The New York-Washington route, not far from the coast, was a "headache" from New York at least as far south as Baltimore. One Bell System man recalls walking the nearby railroad tracks with his brother to bring food to a gang actually beleaguered by heavy snow.

ON THE occasion of the Taft Inaugural on March 4, 1909, the capital itself was cut off by sleet from all communication. When a pair of telephone wires was put back into service late that afternoon, one was placed at the disposal of the Associated Press and the other turned over to the Pennsylvania Railroad. During the remaining days of crisis, the telephone company used all its communication facilities into Washington during the day for the general public and the subscribers to its private line services. But when the business day ended, the lines no longer needed for business firms were employed during the night by the Western Union Telegraph Company.

The Philadelphia-Chicago route through Pennsylvania covered some pretty rough country, an ex-plant man points out, and one stretch of line over the mountains was called "the big flat" because of the many times it lay flat on the ground. The New York-Chicago line west of Harrisburg, Pa., had particularly rough going as well. Both of these routes carried important services and, in case of line failure, little re-routing could be done without affecting the service adversely.

A man about to clear trouble would often fill up a spring wagon with the equipment thought to be needed and disappear into the distance, his office having rather vague ideas as to when he might return. It was often cold work, and the way the men prepared for the weather called forth a comment by an old Irish woman who lived near the test station at Cuyahoga Falls. "Sure, thim linemen can't git cold. They have as minny coats on as an onion." Perhaps she made her observation in

Left: This pole—# 11040—outside the test station at Maumee, Ohio, was a Long Lines landmark for 60 years

Below: Down she comes! But pieces of the noted old pioneer have been preserved in telephone museums and by telephone people

1904, when the New York-Chicago line was hit by a sleet storm so bad that it practically destroyed the route along the 100 miles between Washington, N. J., and Lebanon, Pa.

Fair as Well as Stormy Days

THERE WERE, of course, fair as well as stormy days in maintenance work, days when quiet competence was the only job requirement. But a rather special day was the occasion when a gang rerouting a line near Wilmington, Del., was invited by one of the DuPonts to visit the magnificent Longwood Gardens, where refreshments were served and an organist entertained them.

There were days of high adventure too. Evidently a number of men dwell in memory on the times when they set out in row boats to repair a line—and were nearly swept over the edge of a nearby dam. Then there was the time when a couple of linemen found that the cause of trouble was a thief up a pole stealing wire while another man stood guard with a gun. And there was the exciting episode when a young fellow, looking into the cupola of a parsonage from a tall pole, saw two children starting a fire with matches. Clambering down, he corraled the family and they arrived on the scene just as the fire was making good progress and the children were screaming.

The trio of lines now taking their place in telephone company archives do not represent quite the earliest stage in long distance development. There was, for example, the pioneer line built between Boston and New York in 1884. Nor, to be sure, do they represent even any particular later stage in joining American communities by long distance. South of Washington there were long stretches of line connecting important cities in the '90s, a through link being achieved by 1900. Westward, telephone facilities marched beyond Chicago to Omaha in 1897, to Denver in 1911, and to Salt Lake City in 1913. The last pole of the first transcontinental circuit was placed on June 17 of the following year and coast-to-coast service was opened on January 25, 1915.

Nonetheless, these three lines, which present a fresh morning of telephone pioneering, have engendered reminiscence and emotion to a degree unique in telephony. The recollections of the men who built and maintained these strands of copper joining New York, Philadelphia, Washington, Pittsburgh, Chicago and many another community form vivid chapters in any tale of telephone development. In particular, they disclose warm fellowship rising out of coöperative effort in a great new enterprise and reflect the charm of a simpler America.

New Telephones for a Busy Nation

(*Telephone Story* from the Telephone Hour radio program of June 16)

There's a bright, sparkling telephone set on the table before me. Listen, I'll spin the dial for you.

We took this telephone off the production line because it has a special meaning. We're proud of it because it is the five millionth telephone to be made in Indianapolis, where a new plant was officially opened only nineteen months ago. There, Western Electric, manufacturing and supply unit of the Bell System, built a factory solely for the manufacture of telephone instruments. The plant would cover eight average city blocks; it employs more than 6,000 people. It produces telephones like the one before me at the rate of 7,500 a day. In addition, it turns out 4,500 telephone instruments of other types designed particularly for specialized uses. Altogether, more than 12,000 telephones a day! That's a lot of telephones!

But our country needs a lot of telephone service these days. That means not only new telephones going into homes and offices . . . expanding factories . . . army camps and naval bases . . . government offices and civil defense . . . but also all the vast amount of wires, cables, switchboards, and other equipment needed to connect these new telephones to all the other telephones in America.

We are working hard to meet these demands . . . to provide the best telephone service and telephone equipment possible.

And so tonight, we salute this telephone. It represents all the new telephones and new equipment developed by Bell Telephone Laboratories, manufactured by Western Electric, and operated by your own telephone company. It represents the inventive skill and manufacturing know-how of the Bell System team. It represents our constant effort to supply America with the kind of telephone service that is so important to our country today.

Ever Use a Wheatstone Bridge?

This year brings, in May, the hundred and fiftieth anniversary of the birth of a pioneer in telecommunications, CHARLES WHEATSTONE.

At the age of 21 he set up as a musical instrument maker, which led him into experimental acoustics. About 1834 he was impressed with the great velocity of electric transmission in conductors, which he himself had evaluated with some accuracy. From 1837 onwards, he worked in partnership with W. A. Cooke, who had designed a telegraph instrument, towards adopting electric transmission for telegraphy.

Wheatstone's genius was many-sided. He was a skilled cryptographer: he deciphered hieroglyphic Mss for the British Museum. He invented the kaleidophone, for demonstrating the movements of sounding bodies; he discovered the principle of the stereoscope; he read papers on the physiology of vision and devised a means of analysing metals by examining the spectra of electric sparks thrown off from them. . . .

Of a shy disposition, he yet became Professor of Experimental Philosophy at King's College, London. Governments, universities, and learned societies showered no fewer than 34 distinctions upon him, and ultimately he received a knighthood.

No one man can claim to have invented the electric telegraph, but we may honor Wheatstone as one who may be regarded as the founder of modern telegraphy.

From *Telecommunications* of the
United Kingdom Post Office

Four presidents of Bell System companies who are graduates of the University of Missouri were present at their Alma Mater in Columbia, Mo., on June 5, 1952. In addition to Cleo F. Craig, President of A. T. & T., who was there to receive the honorary degree of Doctor of Laws, they were President William V. Kahler of the Illinois Bell Telephone Company, President Mervin J. Kelly of the Bell Telephone Laboratories, and President Eugene J. McNeely of the Northwestern Bell Telephone Company.

Bell Telephone MAGAZINE

The Telephone Engineer and His Job • HAL S. DUMAS

Communications and the Political Campaigns
A. F. JACOBSON and WILBUR J. PEAK

Service Executives: The System's Chief Operators
MARGARET E. FAWCETT

Radio Off the Beaten Path • FRANCIS M. RYAN

Nickel Conservation in the Bell System

The Significance of Inflation for Bell System People
MARK R. SULLIVAN and KEITH S. McHUGH

Engineering Bell Telephone Plant • JAMES J. PILLIOD

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Bell Telephone *Magazine*

Autumn 1952

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A Medium of Suggestion & A Record of Progress

JUDSON S. BRADLEY, *Editor.* *Published four times a year for the supervisory forces of the Bell System by the Public Relations Department of the*
AMERICAN TELEPHONE AND TELEGRAPH CO., *195 Broadway, New York 7, N. Y.*
CLEO F. CRAIG, *President;* CARROLL O. BICKELHAUPT, *Sec.;* DONALD R. BELCHER, *Treas.*

Who's Who & What's What *in This Issue*

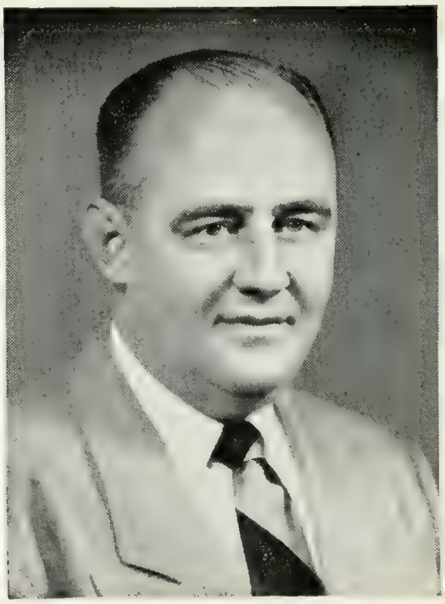
Last Summer's issue of this Magazine said of Hal S. Dumas that for 40 years he had "devoted his life to the Southern Bell Telephone and Telegraph Company, eight of those years as President. Then, in July of 1951, he was elected Executive Vice President of A. T. and T. He started in Atlanta as a troubleman, moved to greater and greater responsibilities through the Plant, Traffic, and Executive Departments, and reached the top in 1943. . . . As Executive Vice President, he assists the President in the general administration of the business, and acts for him in his absence." System executives who seek his counsel, the note concluded, find it flavored with sound judgment. His talk was a feature of the observance of the Centennial of the American Society of Civil Engineers.

The communications features of last Summer's political conventions and of the current Presidential campaigns are expertly discussed in this issue. For A. F. Jacobson, who, as Director of Operations of the Long Lines Department, reviews the broad aspects of this national phenomenon, was until last July Vice President in charge of Operations of the Illinois Bell Telephone Company, with headquarters in Chicago. And Wilbur J. Peak, who is General Information Manager of the same company, was largely responsible for its good-will-building public relations arrangements which were so popular with those attending the conventions.

Mr. Jacobson began as a clerk with the Northwestern Bell Telephone Company in 1922, and by 1945 had become Assistant Vice President—Operations, at company headquarters in Omaha. The next four years saw him successively Assistant to the President, Vice President and General Manager of the Nebraska-South Dakota Area, and Operating Vice President of the Company. In 1951 he was elected Operating Vice President of the Illinois Bell

Hal S. Dumas

A. F. Jacobson



Wilbur J. Peak

Margaret E. Fawcett

Francis M. Ryan

Telephone Company—whence he transferred to his present Long Lines post.

Mr. Peak began his Bell System career in the Accounting Department of Illinois Bell in 1928, and held several supervisory positions there before he transferred to the General Information Department in 1942. He has held his present post since 1949.

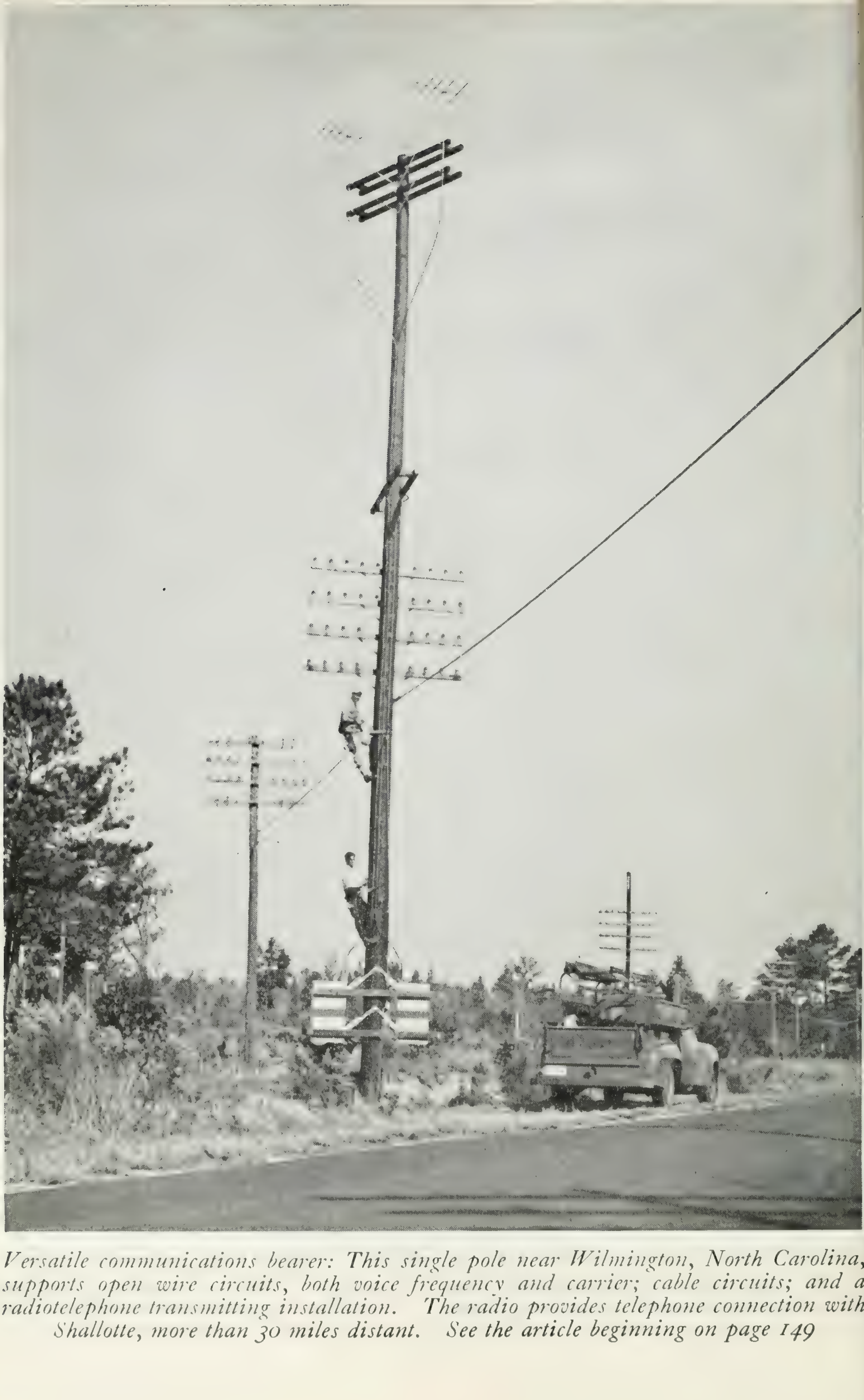
STARTING as an operator in New Jersey in 1916, MARGARET E. FAWCETT worked up through the lines of organization to be a chief operator. When the New Jersey Bell Company was organized in 1927 she was appointed to the staff of the General Traffic Supervisor, but she retained the title of chief operator and worked with the chief operators in various New Jersey offices. In 1928 she crossed the Hudson River to join the Traffic division of A. T. & T.'s O. and E. Department. Here she has worked on operator training plans and on employment problems; and in recent years she has been concerned with central-office management training—which centers around the chief operators and assistant chiefs whom she writes about in this issue. To this MAGAZINE for February 1943 Miss Fawcett contributed "Telephone Women's War-time Off-duty Activities."

EXPERIENCE as a radio operator aboard ships sailing Alaskan waters, as radio inspector in charge of the Seattle office of the Department of Commerce radio service—a forerunner of F.C.C.— and as instructor in radio for enlisted men at Oregon Agricultural College during World War I, preceded FRANCIS M. RYAN'S Bell System employment. He joined the technical staff of Western Electric Company's Engineering Department in 1920, and continued there and with the successor Bell Telephone Laboratories until 1936. In that year he transferred to the A. T. & T. Co. as Radio Engineer, and has held that office since—save for a brief return to the Laboratories a decade ago to supervise the development of sonar equipment for the U. S. Navy, and an interlude as Radio Coordinator for A. T. and T. His most recent contribution to this MAGAZINE was "The Growing Use of Radio in the Bell System," which was published in the issue for Winter 1946–47.

THE EFFECT of inflation on the whole Bell System is emphasized by talks given on the Pacific and Atlantic coasts by the heads of the System's two largest Associated Companies.

MARK R. SULLIVAN started in the Traffic Department of the Pacific Telephone and Telegraph Company in 1912,

(*Continued on page 194*)



Versatile communications bearer: This single pole near Wilmington, North Carolina, supports open wire circuits, both voice frequency and carrier; cable circuits; and a radiotelephone transmitting installation. The radio provides telephone connection with Shallotte, more than 30 miles distant. See the article beginning on page 149

The Telephone Engineer Is Pushing the Frontiers of the Spoken Word Farther and Farther Afield, in the Service Of His Fellow Men

The Telephone Engineer And His Job

Hal S. Dumas

The following is the text of an address given by the Executive Vice President of the American Telephone and Telegraph Company before the "Centennial of Engineering" Convocation in Chicago on September 11, 1952. EDITOR.

IT HAS often been said that God himself was the first engineer, and that the first chapter of the book of Genesis confirms this. The second and third verses of the chapter read, "And the earth was without form, and void: and darkness was upon the face of the deep. And the Spirit of God moved upon the face of the waters. And God said, Let there be light: and there was light."

What I want to emphasize is that the instrument through which the Great Creator began to bring light and beauty and order out of chaos was the spoken word. Please note—and I quote again for emphasis: "God *said,* Let there be light: and there was light."

The record does not specify to whom He spoke. We might suppose it was to the Chief Engineer of His Atomic Energy Department. At any rate, He got immediate and complete results. And those results followed on the heels of the transmission of a word spoken to some cosmic engineer.

Much later, and under humble, human, mundane circumstances, words spoken to the first telephone engineer also brought results.

Mr. Bell, the inventive, creative genius of the telephone, said, "Mr. Watson, come here; I want you." And Watson, the first telephone engineer, set the pattern for all telephone engineers who have come along in his footsteps. He responded immediately. He did the job required, rendering aid where it was badly needed.

We are all familiar with the three great names in the early days of the telephone: Bell, Watson, and Vail.

Bell was the dreamer, the scientist, the experimenter. Vail was the administrator, the salesman, the financier. Watson was the engineer. In my mind, he will stand forever as the prototype for all telephone engineers.

It was he who took the idea of the inventor and converted it into a practical, dependable working piece of apparatus. It was he who translated a dream into a service—useful to the public—that could be sold by the administrator.

The Connecting Link

It is the engineer who must always be the link between the idea and actuality, between the probable and the practical. It is he who makes realities out of dreams. He is indeed the solvent which blends together the many different parts of our great industrial mechanism and produces a smoothly working whole.

The telephone engineer has assembled one of the most complex and wonderful of all modern devices. Here in America, the telephone network covers closely an area of more than five million square miles. It serves one hundred and fifty million people. Each day it turns out for them—immediately upon demand—more than two hundred million individual "tailor-made" services.

The amazing complexity of this communications system shows up in many ways. It contains, for example, more than two hundred million electric relays. Each relay is made up of as many as one hundred separate parts. A simple local call from one telephone in Chicago to another may involve a thousand of these relays, and a long distance call may very well use 4,500 of them. And yet the practical genius of the engineer has so coördinated this complex and wonderful machine that my six-year-old grandson can use it with somewhat too much ease.

It is the job of the engineer to search out the means by which the ideas of the inventor can be put to work in the service of the public. He also knocks on the door of the ivory tower of the pure scientist and calls forth new inventions to meet the needs and wants of the public.

In the telephone business—which, by the way, you could with justice call an art or a profession—the engineer is indispensable. Frequently, because of his experience at the crossroads of the business, the telephone engineer is called on to take on assignments in fields that are new to him.

He may, for example, become an administrator. It has been my observation that in this capacity the engineer often travels a strange and unfamiliar path. He misses many familiar landmarks that marked the exactness of his engineering profession. No more can he rely upon the formulae, or the tables, or the natural laws, or the mathematics by which he has solved his engineering problems.

He must now deal with the human equation, which is really no exact equation at all but rather a conglomerate of hopes and fears, strength and weakness, nobility and baseness. He finds that, in this new realm, facts are never exact and compromise is an ever-present essential.

Only the passion for honest thinking which has been his guiding light as an engineer is left to help him on his way.

Some engineers may fail as administrators until they learn that human nature cannot be solved on a slide rule. But when this lesson is learned, and learned well, the engineer's habit of ordered thought will stand him in good stead and give him an advantage over his colleagues who have not been so fortunate as to have had the rigorous training and mental discipline the engineer receives. At any rate, fortunately, a large number of the administrators of the telephone industry are engineers, through training or inclination, imbued with the engineer's unending drive for straight and honest thought.

It is perhaps when the telephone engineer turns to research and development that he follows the most natural and happiest road. His patience and his methodical curiosity serve him well. He knocks tirelessly at nature's door, demanding her secrets for the betterment of his profession. He coöperates closely and naturally with his colleagues, finding in pooled experience and wisdom the most practical solution to the specific problems at hand.

Teamwork— the researcher who originates, the engineer who adapts, and the administrator who places an idea in public service—has produced a constant stream of improvements within the art of telephony. Today, telephone service is within easy reach of everyone in our country. Never before has so much communication service been available for so little in terms of human effort.

The telephone engineer and his associates have placed 29 telephones at the command of each hundred Americans, as compared with 16 in 1929. And this larger, improved service is available at less real cost to the user. An average factory worker today, for example, earns enough in about two hours to pay the average residence telephone bill for a whole month: in 1929, he would have worked almost five hours to pay the average residence bill for that day and time.

Our country is literally crisscrossed by its communications network. No longer is any section isolated from the rest.

One Great Neighborhood

The vast network of telephone, radio, and television circuits and the many superb services rendered over them quicken the economic pulse of America and help make possible the great miracles of production which astonish the world and reassure ourselves. For it is this tremendously accelerated rate of production that has made possible our living standard and makes us confident that we can defend our country against any possible combination of enemies.

And it seems to me that this great communications system, so largely the product of the labor and dedication of the telephone engineer, has done even more for America. It has made our vast country one great neighborhood. It has broken down the barriers of distance and has brought to each of us a fuller understanding of our fellow Americans. It is helping build a greater unity by eliminating the distrust which is created through lack of acquaintance and contact. How can ill will and dislike continue to flourish when, even though great distances separate them, men speak often together?

A Contribution to His Time and His People

Truly the telephone engineer has made a glorious contribution to his time and his people. There are some living today—perhaps a few within the sound of my voice—who can remember clearly when the telephone was little better than a mechanical curiosity, at best a limited and very unpredictable service. Within our lifetime, we have seen the highways of speech span the American continent and circle the globe. Calls that a few decades ago were few, special, and uncertain are today constant, commonplace, and sure.

To make this service possible, we have drawn on every field of engineering experience and know-how. In many respects, today's telephone service is a high water mark of all engineering achievements. However, this is only the beginning, and tomorrow's telephone service challenges the engineer in fields of accomplishment yet unexplored.

The telephone engineer knows that his job will not be done until every man everywhere can speak to and see his fellow man wherever he may be. A Dick Tracy dream, you say? How shall we cast off the present burden of intricate circuits and complex switching systems, you ask? These questions are the job of the telephone engineer—the telephone engineer of tomorrow. A tough, slow, hard job, but it will be done, and in doing it, the telephone engineer will be laying stone upon stone in the foundation on which men everywhere all around the world may build the close ties of understanding which can be the only basis for a world of peace.

To me it seems no accident that God's spoken word brought order out of chaos and light to a dark and troubled world. It is in the service of his fellow men that the telephone engineer is pushing the frontiers of the spoken word farther and farther afield. It is a work to which he, be he engineer, researcher, or administrator, can proudly devote the years of his life. And as each finishes his career, he can do so with the satisfying knowledge that he has made a real contribution to the progress and happiness of the world in which we live.

Television Brings Candidates for Public Office into Homes From Coast to Coast, To Be Both Seen and Heard for the First Time by Large Numbers of Voters

Communications and the Political Campaigns

I. A New Era

A. F. Jacobson

For over a hundred years, national political conventions have been among this country's most important and dramatic events. Yet not until last July did much of the American public have an opportunity both to see and hear the proceedings by which a man is nominated for the Presidency. They could do so then because the Bell System, keeping pace with the rapid development of the television industry, had, in a few years' time, planned and placed in service the nation-wide network of television transmission facilities which made this possible.

This 30,000-mile intercity network connecting television stations throughout the country was the essential link which enabled more than half the nation to occupy front row seats at the Republican and Democratic Conventions in Chicago. Within a period of two weeks, these facilities made the faces and voices of the country's leading political figures better known to many citizens than those of their local officials.

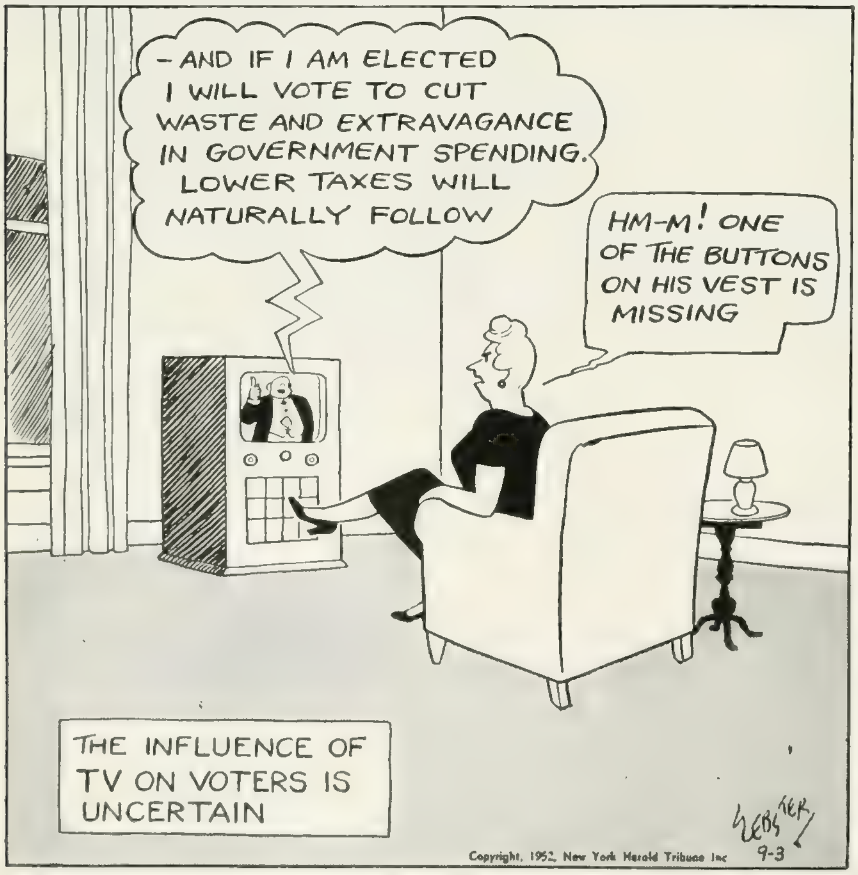
Yet it was only seven years ago that the first public intercity television broadcast of importance occurred, when the 1945 Army-Navy football game in Philadelphia was sent over Bell System channels to New York for broadcasting in that city. At that time there were but 8,000 television receivers in the two cities. Since then the Long Lines Department of the American Telephone and Telegraph Company has extended its network of coaxial cable and radio relay systems from coast to coast and from the Great Lakes to the Gulf, and the Associated Companies have installed hundreds of miles of circuits to make local connections within the cities. Originally developed to meet constantly growing demands for long distance telephone service, both coaxial cable and radio relay can also be used to carry television programs, so that today 99 per cent of the country's estimated 18 million television sets can receive the same program at the same time.

Behind this amazing expansion is a story of achievement possible only in America, under a free government of a free people. It is a story of design, production, and installation; and of skillful maintenance and operation—all requiring a great investment of effort, ingenuity, and money.

Now the conventions are over, and the participants have gone back home. But the political campaigns continue strenuously through the Autumn months as the two Presidential candidates present themselves at every opportunity before the voters of this country—and communications continue to serve them well.

Telephone calls make and confirm arrangements and provide indispensable personal contact. Teletypewriters carry reams of news to the nation's journals and their readers. Discussion, debate, argument, oration pour from the throats of unnumbered loud speakers. Above all, the candidates enter almost daily into American homes on the screens of millions of television sets to make their points, their pleas, their individual impressions. When the election comes, and the voters have made their choice of a new leader for the next four years, his smile of victory and his pledge of service to the American people will reach infinitely more of them than ever before in history, through the medium of television.

The Unseen Audience : : : : : BY H. T. WEBSTER


—AND IF I AM ELECTED I WILL VOTE TO CUT WASTE AND EXTRAVAGANCE IN GOVERNMENT SPENDING. LOWER TAXES WILL NATURALLY FOLLOW
HM-M! ONE OF THE BUTTONS ON HIS VEST IS MISSING
THE INFLUENCE OF TV ON VOTERS IS UNCERTAIN
WEBSTER
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The ultimate effect of television on the political scene is a topic of interesting speculation. For television is the newest medium of dramatic presentation, with a potential audience of the entire nation, and its educational possibilities and effect are tremendous. Its impact upon the audience—as well as on the people before the camera, whether they are entertainers or politicians—is becoming increasingly evident. It seems inevitable that through television the American public will be better informed and have a greater interest in vital political issues of the day. It is quite likely that the mechanics and "stage direction" of television will be important considerations to the political campaigner of the future.

Thus it may well be that some future historian will point to the summer and fall of 1952 as the beginning of a new era in American political consciousness, and a new approach to the conduct of political conventions and campaigns. If this should be so, an important factor in this development—whether recognized as such or not—will have been the Bell System's provision of facilities for bringing political proceedings and personalities to the eyes and ears and minds of American citizens.

II. Political Conventions of 1952

Wilbur J. Peak

On television, over the radio, and through millions of words printed in the nation's press, the largest audience in the history of the conventions "sat in" as the two great political parties argued over delegates, and selected their presidential and vice presidential nominees, in Chicago last July.

What made this gigantic panorama of sight, sound, and words come so spectacularly alive throughout the nation and the world was, in very large measure, Bell System services and team work. From a communications standpoint, the 1952 conventions were the greatest in history. Demands for service from Illinois Bell Telephone Company and the Long Lines Department of the American Telephone and Telegraph Company, backed up by the Associated Companies and Western Electric, were more than 75 percent higher than at the last national convention held in Chicago in 1944.

As the local telephone company, Illinois Bell was host for the entire Bell System. In that rôle, it had the important responsibility of maintaining and enhancing the System's deserved reputation for efficient, pleasing service to the public.

TV Facilities Set Record

Television "stole the show." Conventions of 1940 and 1948 had been televised, the first locally and the latter over a limited network. But with the Bell System's coast-to-coast TV network a reality in 1952, the television broadcasting industry went "all-out" to report the conventions.

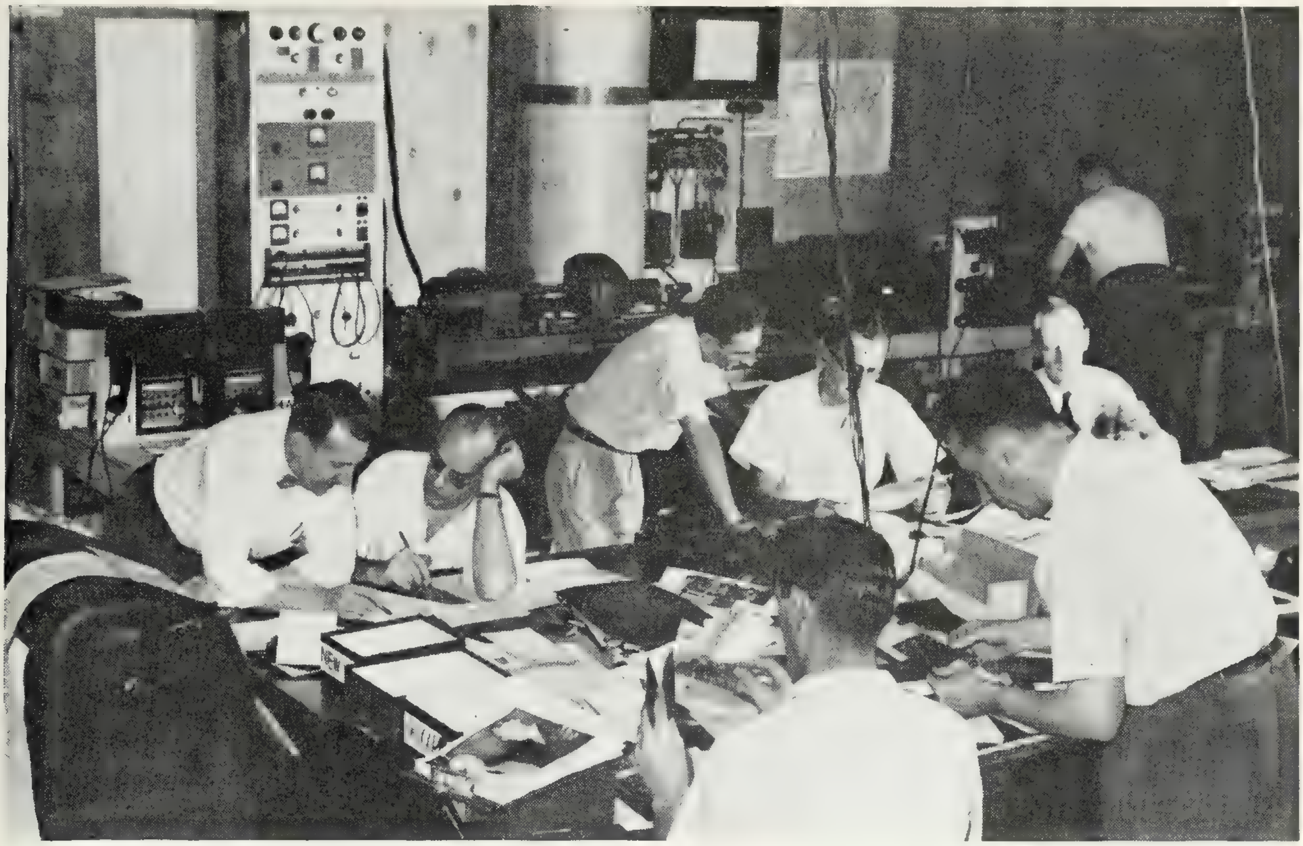
For major news breaks—at the speakers' rostrum on the convention floor, in committee hearing rooms in downtown hotels, or in front of a residence on fashionable Astor street in Chicago—the unblinking Cyclops eye of the television camera was on the scene. And most generally, it took telephone lines to get it there.

Although the TV cameras themselves were often in the spotlight, actually they were only the starting point of an amazingly complex communications set-up. The terminating points were 107 television broadcasting stations in 65 cities served by a nation-wide network of Bell System television facilities. In between was a truly prodigious amount of telephone equipment to switch, monitor, control and transmit the television signals.

To bring network television within range of 99 percent of the nation's TV sets, Long Lines rushed to completion an additional 5,000 miles of microwave and coaxial cable channels, bringing the total up to about 30,000 miles. The new cities which joined the conventions' TV audience were Miami, New Orleans, Dallas, Fort Worth, Houston, San Antonio, Oklahoma City, Tulsa, Phoenix, Seattle, and Lansing, Mich.

In Chicago, along with the television facilities already in place, the largest concentration of television facilities ever amassed at one point were installed to handle the conventions. The flexibility of Bell System organization enabled Illinois Bell to assemble in Chicago what needed equipment it did not already have available.

The Bell Telephone Center was one of the busiest spots in Convention Hall. The girls at the message and information counters handled thousands of messages and rendered other courteous services for delegates and visitors



Bell System communications facilities helped newsmen get their convention stories out fast. Newsrooms like this used a wide variety of services, including telephone, teletypewriter, and telephoto lines

Flexibility was the watchword in planning for convention television facilities. To satisfy the needs of the TV broadcasters, it was necessary to provide facilities to permit pickups from many locations—the convention floor, Convention Building studios, the Conrad Hilton Hotel (headquarters for both Republican and Democratic National Committees), downtown studios of the various TV networks, and telephone buildings from which the TV signals went out on the nationwide network. In all, 24 video channels—including both microwave and cable—interlaced these locations.

In addition, there were other miscellaneous video pickups at such widely scattered locations as the Northwestern Railroad Station, the Midway Airport, where President Truman's arrival was televised, and the elephant house at Brookfield Zoo.

The major television installations were at the Convention Building (International Amphitheatre). From this sprawling, flag-bedecked building in the midst of Chicago's famed Stockyards, television programs were flashed to the networks by means of 12 microwave "dish" antennas and eight cable channels.

To send and receive the best possible TV signals, the antennas were as carefully "aimed" as radar-controlled search lights! But because of their unprotected location, it was feared that vibrations or strong winds might shift them "off the beam." Throughout the two convention weeks, Illinois Bell maintenance men kept a constant vigil to see that their aim was not thrown off even the slightest fraction of an inch. Most worrisome time was the night a violent wind and thunderstorm—with gusts reaching 35 to 50 miles an hour—hit the area. Fortunately, the valuable "dishes" withstood the blow.

No one, of course, could foresee the exact locations where important news would break. When the story did break, a service order meant nothing unless the facilities could be installed speedily. Time after time, Illinois Bell plant men met difficult deadlines; work days often ran 14 hours or longer.

For example: sentiment was mounting for Eisenhower late Wednesday of the Republican convention. So Illinois Bell received urgent requests for additional TV circuits to the Blackstone Hotel, where Eisenhower was the No. 1 guest. Nearly all TV men wanted their circuits immediately, and only one was available.

The only solution was to run a line across the street to the Conrad Hilton Hotel. Running it overhead was impossible because it would have violated City ordinances. Obviously, there was no time to dig up the street and lay the cables underground. Western Union Telegraph Company came to the rescue by offering use of its under-the-street conduit.

Ordinarily, a job of these proportions would have taken three normal work-days to complete. But an oversized telephone crew working throughout the night did the job. In 14 hours the circuits were in and operating. They made possible the nationwide TV coverage showing "Ike" right after he received the Republican nomination for President.

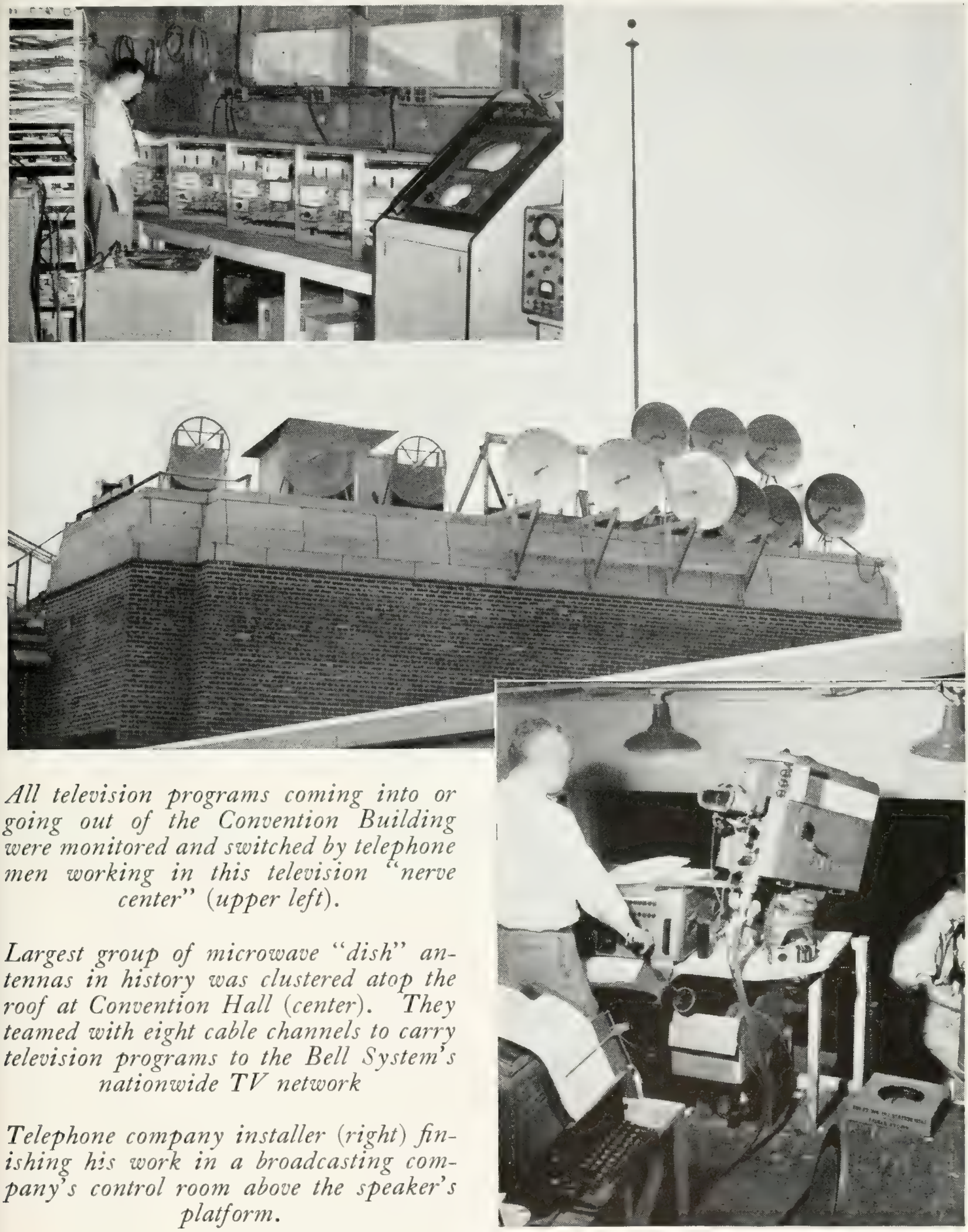
Press, Radio Required Great Amounts of Telephone Service

DESPITE the phenomenal reporting job done by television, the news coverage by the old stand-bys—newspapers and radio—was also of record-breaking proportions. Long Lines carried the ball here too. More than 670,000 miles of teletypewriter circuits served some 7,500 press outlets. On the radio side, more than 1,200 stations received their programs via Long Lines radio channels. This network was fed by 215 radio channels in Chicago.

In the Convention Building, telephones and teletypewriters were installed in the press section on the convention floor for many of the representatives of about 150 newspapers and other publications.

In addition, more than 50 press rooms were set up for press services, newspapers, and magazines in the south wing of the Convention Building, and all required telephone company services. Almost that many more were in the Hilton Hotel. Forty-three radio stations had offices in the Convention Building; 34 were in the Hilton. Service demands for these ran all the way from a single telephone to the batteries of instruments, switchboards, telephoto lines, and other special equipment required by the news services. Radio pick-up spots from the floor of the convention to the control booth alone required the placing of 156,000 feet of wire. More than 100 teletypewriters were installed to send and receive millions of words written about the convention.

One of the most unusual radio set-ups which used Bell System fa-



All television programs coming into or going out of the Convention Building were monitored and switched by telephone men working in this television "nerve center" (upper left).

Largest group of microwave "dish" antennas in history was clustered atop the roof at Convention Hall (center). They teamed with eight cable channels to carry television programs to the Bell System's nationwide TV network

Telephone company installer (right) finishing his work in a broadcasting company's control room above the speaker's platform.

cilities to report convention news was the "Voice of America." This is the radio arm of the State Department. It beams the story of American democracy all over the world in 46 different languages, concentrating on Iron Curtain countries and others where communism is a threat. Its transmitters send radio beams over 95 per cent of the earth's surface.

At the conventions, the "Voice of

America" headquarters was a small recording booth located in the radio section. Special telephone lines connected this booth to the "Voice's" New York headquarters. Every day during the conventions, reporters speaking different languages went out into the convention hall to get stories of interest to the countries for which their broadcasts were prepared. Among the "interviewers" was a telephone engineer who explained how television was being carried from coast to coast. Each of the reporters made two tape recordings a day. These were transmitted to New York, where they were edited and then included in the programs for each particular language group.

Furnishing Regular Telephone Service Was Biggest Job

THE BIGGEST telephone job, however, was simply that of providing regular local and long distance service. Here are a few scattered statistics to illustrate the scope of the service required—although they reveal nothing of the intense pressure under which much of the work was done:

More than 20 PBX switchboards and 1,000 telephones were installed at the Convention Building, the Conrad Hilton Hotel, and other miscellaneous locations for the Republican and Democratic national organizations. In addition, the hotel headquarters of the various candidates for the Presidential nominations required large and widely varying amounts of regular telephone service.

Illinois Bell workers added or rearranged nearly 5,000,000 feet of wire to care for Convention communication needs. More than 100 additional public telephones were installed in the Convention Building.

Western Electric Company played a key rôle in enabling the Bell System to meet this communications challenge, handling expeditiously all orders for the manufacture of special cable and wire facilities. In addition, the Bell System's manufacturing and supply unit set up a streamlined procedure for stocking and delivering countless items of telephone equipment to handle any contingency. W. E.'s installers put extra switching and other equipment in several Illinois Bell local and toll offices.

Working against "impossible" deadlines was, of course, the most common single problem. Cramped quarters was another bugaboo to telephone men. Cable work in the Convention Building itself was not so difficult because it is of the "open type" construction. However, at the Conrad Hilton it was an entirely different story. Plant men working there had to be "human flies" to do their job. Conduit in which the cable normally is placed is built into the solid walls of the hotel. When it was filled, there was nothing to do but take to the outside walls. Cable was secured to the back side of fire escapes or fastened onto the masonry with hooks.

Telephone Men Worked Long Hours

BIGGEST single difficulty was the inability to gain early access to Convention Building and hotel premises. Another convention occupied the Amphitheatre until after June 24, so telephone work had to be done "on the double" right up to the opening of the Republican Convention on July 7. Access to hotel rooms was, similarly, held up by non-convention guests. For two weeks prior to the convention's opening, telephone installation work continued from 8 a.m. to midnight daily. The Fourth of July holiday week-end become just more "regular" work days for the telephone men who had an important job to do. Then, just when they were catching their first easy breaths, a flurry of late orders came in right at the opening of the convention itself.

In line with the System's policy of protecting secrecy of communications, men from the Claims Department kept a sharp look-out for any attempt at wire tapping or sabotage. In addition, a constant patrol along cable routes bearing possible convention traffic was maintained during convention weeks.

"*Service*" *Was the Telephone Keynote*

WHEN it was first indicated, almost a year ago, that the 1952 national political conventions would be held in Chicago, a Bell System Convention Committee was set up to map out the telephone companies' rôle. It was recognized immediately that the conventions would require both large amounts and special kinds of telephone facilities. Also, the committee foresaw that a specialized method of delivering "call-back" messages would be needed. Thus, to provide the best possible service for officials, delegates, press, radio and television representatives, and the thousands of convention visitors, Illinois Bell developed plans for a Bell Telephone Center, a telephone "press room," and a special convention telephone directory.

The Bell Telephone Center provided an extremely popular and use-

Swift installation of public telephones was good "news" to members of the press, radio and television keeping a 24-hour vigil at Astor Street. Telephone men had booths in operation an hour after they arrived ful service. Indeed, it was one of the busiest spots in the Convention Building.

The main section of the Telephone Center was 75 feet long and 25 feet wide, and at that it was crowded most of the time. Simple and pleasing in design and decoration, it was conveniently located in the north wing of the Amphitheatre near the convention floor. In it were 12 open sit-down booths of new design for local calls; nine sound-proofed booths for long distance calls, together with two associated attended positions; three banks of counters for the message center girls (working at 16 positions); lounge seats, water coolers, booklet racks, and a telephone manager's desk. As an added service for the visitors, there was a unit containing receivers connected to the weather bulletin service. Across the aisle were 30 more unattended public telephone booths for local and long distance calls.

Immediately behind the Center were an employees' rest room, a special public television lounge, two small customer rooms, and the telephone press room.

Message Center Was an Information Bureau

The most unusual feature of the Bell Telephone Center was the special message counter. It was set up to expedite incoming and outgoing messages and to serve as an "information bureau" for all convention people. Operated by the Commercial Department, it was the first undertaking of its kind for any convention.

The Message Center was staffed by 50 telephone girls, selected from all departments, specially trained for the job. Both the message center and attended pay station girls wore attractive navy blue dresses.

These "personality girls" soon became the unofficial belles of the convention, and their friendly helpfulness contributed greatly to the success of the Telephone Center. They appeared in some 30 television and radio programs, many on coast-to-coast networks. And they had the opportunity of meeting many of the "great names" of the conventions and serving thousands of visitors who quickly discovered the Telephone Center.

All incoming local or long distance calls received at the Center's special number—BIshop 7–9141—were answered by telephone attendants. They would record the messages and place them in sealed envelopes bearing the names of the persons called. The messages were then delivered to the convention floor—either through the sergeant-at-arms' pages or by a telephone man. In several cases of top emergency calls, a "handie talkie" two-way radio set was used to reach people on the convention floor. The telephone man delivering an emergency message carried the "handie talkie" with him on the convention floor so he could report back to the Message Center.

If the person for whom the message was intended could not be located, it was returned to the Message Center and kept in file. Meanwhile, the person's name was continuously flashed in large letters on a special illuminated screen which worked in conjunction with a teletypewriter.

More than 30,000 local and long distance calls and requests for information were handled during the two conventions. Included in this total were nearly 5,000 messages for delivery to persons on the convention floor or elsewhere in the convention hall. In addition, more than 3,400 outgoing long distance calls were handled at the attended pay station.

The Message Center contributed to telephone service in another important way. A large proportion of the messages delivered to delegates and others were "call back" requests. Because of the special effort made to deliver all messages, even while the conventions were is session, delegates and others were able to return important telephone calls promptly.

Another interesting feature of the Telephone Center was the television lounge, provided essentially for people waiting for "call backs." Here, they could relax in comfort and watch the proceedings of the convention on television. So that persons making telephone calls would not be disturbed, the sound portion of the telecast could be heard only through earphones located at each seat. The TV sets were provided for use in the Telephone Center by the manufacturers.

Odd Requests at Telephone Center

Although the Telephone Center was primarily designed and operated to serve as a communications headquarters, the Bell attendants received a large and frequently odd variety of non-telephone requests.

On the opening day of the Democratic convention, a perturbed member of the Iowa delegation came to the Center and asked for help in locating some stalks of tall corn. In their usual resourceful manner, our people learned that cornstalks could be obtained at a nearby feed store. However, when they were delivered at the Convention Building gate, an unsympathetic guard refused to let them inside. A telephone girl located the building superintendent, who straightened things out, and even found room in a refrigerator to store the cornstalks until time to use

A plant man making one of the many telephone installations on the speaker's platform them in the demonstrations. With his cornstalks safely taken care of, the Iowan told the telephone girl: "Thanks for helping me, honey! That corn would have started popping if it had been left outside in this awful heat much longer."

Also having nothing to do with telephone service, but contributing greatly toward telephone people's reputation for friendliness and helpfulness, were filling requests at the center for such things as pencils, paper clips, tape, glue, safety pins, straight pins, and dozens of other items. Once a member of the Utah delegation rushed into the Center and asked where special arm-bands could be made up in a hurry. A firm was found, the order placed, and 24-hour delivery arranged. The delegate went away with a hearty thanks for "such splendid service."

IBT Maintained "Telephone Press Room"

ANOTHER SERVICE provided by Illinois Bell was a "Telephone Press Room." Located near the Center, it was staffed by a news service representative and a stenographer from the General Information Department.

These people were able to help newspaper, radio and TV reporters secure special stories with a telephone angle. It also issued a daily "Bell Telephone News Letter," featuring convention items with a telephone background. This news letter not only served to keep our people informed of what was happening, telephone-wise, but newsmen found it a useful source of information.

To further serve the national political conventions, Illinois Bell prepared a special directory for each convention. It contained the names, locations, and telephone numbers of convention delegates, officials, presidential candidates, various national and local political organizations, and so on. In addition, it described the telephone services available at the Bell Telephone Center at the Convention Building and contained other telephone information, such as a table of long distance rates from Chicago to various cities throughout the nation. The directory was distributed to all delegates and alternates, convention officials, hotels, railroad stations, headquarters of all local political groups and other appropriate places. At the request of the Democratic National Committee, this directory was included in the official convention kit of that party's delegates.

Illinois Bell's Directory Division each day published a "Special Convention Bulletin" containing an up-to-date list of special convention telephone numbers. Although originally intended for information operators, the Bulletins were also distributed to press, radio, and TV headquarters at the Convention Hall and political headquarters at the various hotels. Copies also were sent to all hotel PBX operators.

"Operation Astor Street"

ALTHOUGH dozens of instances occurred during the conventions that might be used to typify the efforts of the telephone company to provide service "when and where wanted," none were as dramatic as "Operation Astor Street."

It began on Thursday morning during the Democratic convention. As the sentiment for Governor Adlai Stevenson began to reach "draft" proportions, anything he said and did was news. The Governor was headquartering in the William Blair home, on Astor Street, in Chicago's near North Side.

A small army of newspaper reporters and photographers and radio and television men began a vigil that was to last for two days and nights. With from 30 to 50 newsmen on the scene, telephone service immediately became an important need, since there were no public telephones within several blocks. Illinois Bell was soon flooded with requests for telephone, television, and radio facilities.

Plant men hurried to the scene. Some of the installers climbed the stately elm trees shading the street to string wire and cable. *Time* magazine described this as "cables streamed out of the trees like boa constrictors." Others assembled nine public telephone booths, and set them up outside the residence. Within an hour after they arrived, the telephones were operating. And all the curious neighbors were getting a fine demonstration of Bell System speed.

However, more telephone service was still needed. At 5 p.m., Illinois Bell's telephone trailer, which had five public telephones, was pulled out of the Convention parking lot and rushed to the scene. Before it was all over, there were more than 40 circuits working, including radio channels, TV audio circuits, and more service for the Blair home itself.

Telephone Folks Received Plaudits for Convention Efforts

For telephone people, the convention job was always fascinating, frequently exhausting, and forever exacting. But it was fun to get the cheers, and the cheers did come.

Many political figures of both major parties, and members of press, radio, and television organizations, had words of praise for the communications facilities provided, and for the telephone people who served them so pleasantly and efficiently. One reporter who realized that the Bell System was intent on doing a first-rate all-round service job was a staff writer for *Advertising Age*. His article, entitled "Public Service and Public Relations Is Bell's Convention Motto," began like this: "If any delegate to last month's political conventions was not aware of the Illinois Bell Telephone Company, then he probably never left home." And in further recognition that it was a thoroughly "service first" undertaking, he wrote, "This was definitely not an operation in which 'the dimes jingled merrily as they rolled into the cash box.' "

Traffic Departments' Eleven Thousand Chief Operators Have Made Outstanding Contributions to the Tradition of Fine Telephone Service

Service Executives: The System's Chief Operators

Margaret E. Fawcett

Telephone operators, with their service assistants, form a team which is important to the communities they serve, and to the nation.

Their importance increases as the number of telephones and calls increases. It is interesting to realize that in 1940, when 60 percent of the System's telephones were equipped for dialing, there were 118,000 operating employees. Now, with 80 percent of the telephones dial operated, there are about 250,000 operating employees. Even with dial operation, operators are needed to assist customers, to furnish telephone numbers, and to complete toll calls the customers cannot dial.

Guiding the efforts of operators and service assistants are about 11,000 women: the chief operators and their evening, night, and assistant chief operators. It is a group of carefully selected and well trained women, who have come up through the ranks, and are well informed, practical, and experienced.

Chief operators have jobs which require executive ability comparable to that needed in running a sizable business. And today, that ability is confronted with many challenging problems—among which are equipment shortages, and difficulties in maintaining an adequate and well trained force.

In some localities, unforeseen developments and shortages of strategic materials have temporarily outstripped the ability to keep up with service demands. So an inadequate number of circuits and switchboard positions in some offices calls for ingenuity and skill to make the best use of what is available.

Added to that, there has been a very large number of new employees since the Korea war, all of whom have to be trained under the guidance of the chief operators and those

A Chief Operator talks things over with a Service Assistant in a typical central-office setting of operators, service assistants, and clerk

who assist them. These additions are running currently at about 10,000 new operators a month in the Bell System.

While relatively few employees leave to take other jobs, the qualities that make good operators apparently make good wives and mothers. So marriage and home duties cause resignations, and the forces need constantly to be replenished, as well as increased to permit the handling of an ever rising number of calls.

Recruiting and Hiring Applicants

In many places, recruiting is a responsibility of the chief operator, and this involves, directly or through her assistants, many discussions with the force and with the schools—the best and most productive sources of applicants. There may be participation in school "Career Days," and visits to the office from counselors, teachers, and students so that they can see for themselves what a good job telephone operating is.

After recruiting comes employment, which means that applicants at the Telephone Company are interviewed and tested, the job is explained, and decisions as to employment are reached. While some large and medium-sized cities have centralized employment offices for women, hiring new employees is an important responsibility of the chief operator

Here a Chief Operator is leading an induction discussion on "What do we want from our jobs?"

or one of her assistants in many other communities.

A Typical Central Office

In order to learn more about what a chief operator does, let us take a look inside a typical central office—one with an operating force of about 125 people, let's say. There are many offices larger than this, but the trend is toward the smaller ones.

In the operating room, the chief operator is in charge and works day hours. An evening chief operator and a night chief operator report to her, and one or more assistant chief operators, who may be assigned to day or evening hours, depending upon the needs in individual offices.

As we observe the operators at the switchboard, we naturally notice also the service assistants, or supervisors as they are called in some places: women who are either standing or sitting in back of the operators. Among the important duties of these people are a share in the responsibility for the quality of the service given in their offices, the training of operators, and the furnishing of assistance to operators with difficult and emergency calls.

Such an emergency call came recently to an operator who answered a switchboard signal and heard a customer mumble something that sounded like "help me, help me." Then there was silence. The operator signaled her service assistant, who went to the position immediately. There was no hint of what the difficulty was, but the operator remained on the line while the service assistant obtained the calling customer's name and address from the records, and sent the police to investigate. Later, an officer told the waiting operator that he needed an ambulance at once for he had found a family overcome by coal gas. Prompt aid enabled all members of the family to recover. A fine example of good team work; but to the operator and the service assistant a natural result of training and experience.

We note next the young women working at office desks. These are the central office clerks. They look after such matters as assigning hours, preparing the payrolls, and maintaining various records required in running a central office.

As we look around we may find the chief operator talking with an operator who is consulting her on a personal problem, or discussing a service program with an assistant, or performing any one of the many duties for which she is responsible. If the chief operator is not in sight, one of her assistants will be there, acting for her.

One of the chief operator's objectives is to be available to those who want to consult her. This was certainly accomplished fully in one office, where a young woman wanted to see the chief operator before she went to her switchboard position. To the assistant chief operator's tactful: "The chief operator is at a meeting. Is there anything I can do?" She replied, "No, thank you. The chief operator said no matter how busy she happened to be, I could see her any time." When the chief operator came, the operator opened her left hand, turned her ring, and displayed it proudly. It was a diamond, and she wanted the chief operator to be the first one in the office to see it and to share her happiness.

Service First—and Always

While a chief operator has many responsibilities, they can be summed up in the word *service.* It means accurate, fast, courteous telephone service that meets objectives in quality and economical cost. It results when every one in the office plays her part well on the team; and it is the chief operator's leadership in carrying out the Company's policy of fair treatment of employees that wins their willing acceptance of service objectives.

Not only must the chief operator obtain the support of her force. She must work in harmony with her coördinates in other departments, so as to obtain a maximum amount of interdepartmental coöperation—because every employee, regardless of title or

A group of Chief and Assistant Chief Operators are discussing Company policies with their Operating Vice President department, shares in giving good telephone service.

There is constant vigilance to maintain good service, and there are various ways of determining its quality. In many of the central offices, sampling is done by a separate group of people called "service observers." Personal observations by the chief operator and her assistants and comments from operators themselves play an important part because giving good service is everybody's business in a central office. Above all, there are the customers' reactions: favorable, or unfavorable, oral or written. Service consciousness being what it is in the Traffic Department, chief operators are ever alert for indications of trends toward slow or potentially unsatisfactory service, so that prompt action can be taken before real trouble develops and the customer notices it.

Administration of the Force

A MAJOR RESPONSIBILITY in giving service is the organization of the operating force.

It is necessary to have an adequate number of operators and service assistants on duty during the hours they are needed. Usually, central offices show definite traffic patterns. For example, offices which serve wholly business areas are usually busy throughout the day, with decreased traffic in the evenings. Offices which serve predominantly residential areas are busiest mornings and evenings.

If the office serves a military establishment, evening and Sunday traf-

Chief Operators hear one of their committees make a report at a conference held at a college discussion center fic will be heavy, because men and women in the country's services need no publicity to make them aware of the value of telephone communication. Conversations with the home folks are one of the average service man's or service woman's favorite relaxations. The entire central office force is aware of what these calls mean to service personnel—as witness the following incident.

An unusually large number of ships arrived at a Navy base on a Friday night. The boys had been at sea a long time and, judging from past experience, the central office serving the area would be flooded with calls over the week-end. The chief operator asked all operators scheduled to be off Saturday or Sunday if they would be willing to work on both days. Not only did every one volunteer to work, but there was not a single absentee, and a record number of toll calls was completed. On the following Monday morning, the chief operator was in the office early to greet each operator as she came on duty and to thank her for the personal sacrifice made in order to live up to the tradition of giving good telephone service.

Calls made during the night, while relatively few in number, are obviously important ones, often involving sickness and death, fires and accidents, burglary and other crimes. Yet not all are unhappy events, for many an exuberant new father has been known to make long distance calls to relatives and friends in the small hours of the night.

Adjusting the Force

While it is necessary to provide an adequate operating force around the clock, consideration and skill are used to keep the tours of duty and lunch and relief periods as closely in line with operators' preferences as possible. An operator may obtain permission to change hours with another when she wishes to do so, or have another operator work for her on a Sunday or holiday, and much trading of hours and days off goes on in a central office.

Although schedules are prepared carefully, traffic can and does fluctuate by weeks, days, and even hours. The weather is the chief villain in upsetting schedules, but a community event which attracts unusually large crowds will cause a decrease in the number of calls, while a major disaster may bring a deluge of calls, both outgoing from local telephones and incoming from other cities.

All this means that the chief operator must adjust her force to daily and hourly requirements. For too few operators means too many calls for the operators on duty to handle satisfactorily. On the other hand, provision of an unnecessary number of operators is not economical; and, strangely enough, it may also cause slow service, because an operator finds it easier to be attentive when she is occupied with a balanced number of calls, neither too many nor too few.

A Well Trained Force

To be effective in giving service, a force of operators must not only be sufficient in numbers—it must be well trained. So, training of one form or another is going on constantly in a central office.

To meet the various needs, specific training courses have been developed. They are based on analyses in each office, emphasize the giving of sufficient practice to meet specific objectives on accuracy and speed, and are planned to develop each individual's self-confidence. They are really tailor-made for each office, and flexible as regards application to individuals.

Induction and Training of Operators

Operators' training is handled in two parts or divisions.

Initial training consists of discussions; of practice calls on practice equipment—with as close a simulation of real calls as possible; and of drills. Following the initial training course on practice calls, new operators start handling customers' calls, under the guidance of a service assistant.

Subsequent training consists of acquiring greater skill, learning infrequently occurring operations omitted from initial training, and further training to meet individual needs.

Along with the training is interspersed a supplementary program. For many new operators have never held positions before, and it takes time for them to fit into a working environment. They need sympathetic understanding of their efforts to learn telephone operating, and they need help with personal problems of adjusting themselves to the job and making new friends—problems they would encounter in any job.

Caroline, for example, came from a small village to live with her aunt in a large city. Telephone operating was her first job, and it was easy to see that she was having difficulty adjusting herself because she was homesick. The assistant chief operator helped her to make friends and discussed with her the frequent increases in pay she would receive and the many job advantages to which she could look forward—but Caroline was still homesick. Then one day the assistant chief operator asked, "How would you like to have a long week-end off, so that you can go home and visit your folks? The next time you work on Sunday, we can give you the following Friday as your day off and then not schedule you for duty until the following Tuesday. We give all operators regular turns at these long week-ends." Caroline was delighted, of course, and enjoyed her visit home. When she returned, she said to the assistant chief operator, "My father thinks this is a wonderful Company, to take an interest in one person like me, and he says he wouldn't let me quit even if I wanted to, but I like it here now."

The chief operator participates in the supplementary program, and conducts some of the discussion personally, in order to become well acquainted with the new employees. She also follows the training of new employees with interest, and supervises it to the extent that she knows it is being done well and agreeably.

Service assistants are carefully selected from the operator group; and while seniority is a factor, the principal consideration is possession of the necessary qualifications for the job—the tangible qualities of skill and the intangible ones that constitute good leadership.

Selection and Training of Assistant Chief Operators

When a service assistant is appointed an assistant chief operator, she becomes a management employee, with broader responsibilities and increased authority. There will be many occasions when she will be in charge of the office: evenings, Sundays and holidays, and she may be called on to take the chief operator's place in her absence on vacation, and while she is attending conferences or is on special assignments. There will be many opportunities to exercise judgment and use initiative.

The chief operator assigns specific duties to the new assistant chief operator, personally outlines her responsibility and authority in connection with the duties, and gives her most of her training.

Just as valuable as was the induction into the business is the induction into management. The new assistant chief operator now assumes management responsibilities in interpreting and applying Company policies and practices. Much of this knowledge is given to her by the chief operator, both through example and in discussions. Many of the Companies have also been implementing these discussions with special courses on Company policies and practices. Where there are a number of appointments during the year, it is usual to hold meetings several times a year in a central location, usually Area or Division headquarters. All those appointed since the previous meetings are invited to attend, and arrangements are made for them to meet Company officials, department heads, and persons with whom they will have telephone contacts or to whom they will forward reports.

These programs are not only informative: they induct the new assistant chief operators as active associates in managing the business. The assistant chief operators value these programs highly, and are elo-

Long Lines Chief Operators meet with an Area General Traffic Manager and his staff to discuss delegation of duties

Their 24th consecutive monthly service index of 99 called for a celebration among the Traffic folks in a central office. The Chief Operator cuts the cake while members of the force look on

quent in expressing their appreciation—as this example selected from many similar comments will show:

> "While I gained much from reviews of reports and practices, I appreciated more the discussion of policy. Hearing higher management express views, ideas, and goals—the intangible things necessary for good business—showed us thoughts and principles of a program of service that we cannot find for ourselves in books. It gives an unbelievable lift to morale, and a sense of actually belonging—being a part of the Company."

Selection and Training of Chief Operators

IT IS TRADITIONAL in the Bell System for executives to start their careers in beginners' jobs, and chief operators follow this plan by starting as operators and working their way through various jobs—demonstrating their ability in each one. No risk of failure can be taken with the promotion to chief operator, because good communications are vital to a community at all times, and good service depends largely on the ability and leadership of the chief operator.

Experience in every phase of central office operation, plus high qualities of leadership, give the new chief operator a sound start in her job. She gets further training according to her needs, administered under the direction of the District Traffic Superintendent to whom she reports. It includes on-the-job training and direction as needed, meetings with other chief operators in which common problems are discussed and good ideas pooled, visits to other offices to observe specific aspects of office management, and attendance at training conferences led by competent staff men and women.

Even after a chief operator has had her training, and is thoroughly familiar with her job, she continues to learn—because she realizes that a person who stops learning stops progressing. Chief operators know that, while service goals remain constant, people and times do not. As one chief operator said: "There is no use wasting time complaining that young people today are different. Basically, they are just as fine as they ever were and our job is to understand them and be able to obtain their coöperation."

Chief operators generally are aware that, important as technical skill is, the development of the "spirit of service" in their employees is of equal significance. One of the essential duties of their jobs today is to instill this willingness to serve into the many new employees entering the business.

Helping Chief Operators to Plan Their Work

Many chief operators have watched their offices grow to the point where it is now necessary for them to be executives only, training, guiding, coördinating, inspiring others but refraining from becoming involved unnecessarily in the details of operation.

An illustration of this change is an office that up until a few years ago had a steady, gradual growth. The installation of a huge defense plant brought housing developments, additional stores, and various new businesses that doubled the number of calls being handled in the office. Within one year the operating force increased from 150 to 308. During the year, in addition to new operators trained, 21 service assistants and 5 assistant chief operators were selected and trained. Throughout this year the service was good. A remarkable accomplishment! But, as the chief operator said, "I could never have gotten through the year successfully if I had not been trained to organize my job and to delegate responsibility."

As a result of this training in organizing and delegating central-office management duties, the chief operator frees herself from as many of the details of managing the office as possible. Thus she has more time for training her assistants, supervising the over-all job, and promoting mutual understanding and friendly relationships among all members of the force.

Despite their busy work schedules, chief operators find time to participate in many civic and social activities. Many of them belong to women's clubs, community chest com-

A central office in 1888. The scene has changed, but not traditions of good service mittees, Red Cross, and are active in their churches as leaders of women's groups and as Sunday school teachers.

They have been honored in their communities as "Woman of the Year," interviewed on the radio as "Woman of the Week," and cited in numerous newspaper articles for service to the community.

Small-Office Chief Operators

While the mention of assistants throughout this story seems to indicate that only medium and large offices are involved, this is not the case. In a small central office serving a few hundred customers, service is just as essential as it is in offices serving many thousands.

The chief operator in a small office frequently has to be more versatile and self-reliant than her sisters in the large offices, because she has more to do personally. As one small-office chief operator remarked: "When I look around for someone to delegate to, here I am."

The small-office force has the advantage of knowing most customers personally and being known by them. When a staff visitor was complimenting a chief operator in such an office on the pleasing, friendly voices of her operators, the C.O. answered: "It is easy to be pleasant, because all these customers are our friends. Besides, if anyone did have an 'off' day, a customer would remark, "what's the matter today, Mary?"

Chief operators in small offices can take pride in the really excellent personal, pleasing service they render. Their contributions to the nation's service is great in the aggregate, because there are so many more small offices than there are large ones.

To all chief operators everywhere, including our friends in Independent Companies, a sincere tribute for their high ideals of service—ideals that are not only passed down through the organization but upward as well. Many executives of the various telephone companies are generous in acknowledging the good start in the business given to them early in their careers by their chief operators.

All departments of the companies recognize the chief operators' good work and outstanding contributions to the successful operation of the business. But in the Traffic Department, where they are known best, they have earned also a high degree of confidence and affection. No matter what the future holds—good times or bad, peace or war, surpluses or shortages—the chief operators will continue doing the same fine job they have done in the past and are doing today.

Radio Carries Telephone Service to Out-of-the-Way Places As well as Transporting Telephone Messages on Major Cross-Country Routes

Radio Off the Beaten Path

Francis M. Ryan

In the short period since the end of World War II, the Bell System has brought microwave radio relay technique from the research laboratory through the development stages to full-scale commercial utilization. It has spanned the continent by radio relay facilities, which are providing hundreds of thousands of miles of long distance telephone circuits between many of the principal cities of the country. Used also to provide much of the ever-expanding television network serving the TV broadcasting stations of the country, the Bell System's radio relay facilities have been given wide publicity.

Not so well known, but nevertheless of importance, is the Bell System's use of radio to provide telephone service off the beaten path.

The first use of radio for this purpose was to provide service to islands. Indeed, the first regular day-in and day-out use of radio by the System, more than thirty years ago, was to provide telephone service to the town of Avalon, on Santa Catalina Island, thirty miles off the California coast. Now, in addition to being used to serve islands, radio is being employed by Bell System companies on overland routes to reach many out-of-the-way places.

When, for example, more than two years ago, Richard Reeve, owner of Bellota Ranch in Arizona, asked the Mountain States Telephone and Telegraph Company for telephone service, it was provided by the use of radio. Bellota Ranch, which includes 90 square miles of grazing land, is located about 28 miles east of Tucson, Arizona, in the Santa Catalina Mountains. Thirteen miles of rugged, mountainous, almost impassable country lie between the ranch and the nearest pole line of the telephone company. The construction of a telephone line through this country to the ranch would have been very expensive, and the maintenance would be difficult.

The radio system installed to serve Bellota Ranch was an adaptation of the type used for mobile telephone service in urban areas. It operates on one of the channels in the 152–162-megacycle frequency range employed primarily for "urban" mobile telephone service. The Federal Communications Commission wisely provides in its rules that these frequencies may be used secondarily for "rural subscriber" and "short haul toll" telephone service. It is under these provisions that systems such as that serving Bellota Ranch operate.

Cheyenne Wells Radio Service Was Installed in 1946

THE BELLOTA RANCH installation was by no means the first experience of the Mountain States Company in the use of radio to provide telephone service in a rural area. In August of 1946, this company established an experimental radio system at Cheyenne Wells, in eastern Colorado, serving eight farms. The central installation of this system is at the telephone central office in Cheyenne Wells. Four of the farms, 11 to 21 miles distant from town, are served directly by radio. The other four are reached by short wireline extensions from one of these farms.

The Cheyenne Wells rural radio system operates in the 44–50-megacycle frequency range employing equipment of the type used for "highway" mobile telephone service and especially adapted to provide features necessary for rural telephone service. These include special power equipment to enable operation from the available farm lighting plants, and arrangements which permit communication between subscribers on the radio system as well as with those on the general telephone network reached through the Cheyenne Wells central office.

The Cheyenne Wells system has served this rural area well for more than six years. Particularly during severe winter weather it has been of great value, providing snowbound ranchers with communication with doctors and aiding in many ways the operation of their farms. The area is continuing to grow, and wire telephone lines are being built to serve not only the farms now reached by the radio system but others. With the completion of the wire line construction, this pioneer radio system will be retired from service.

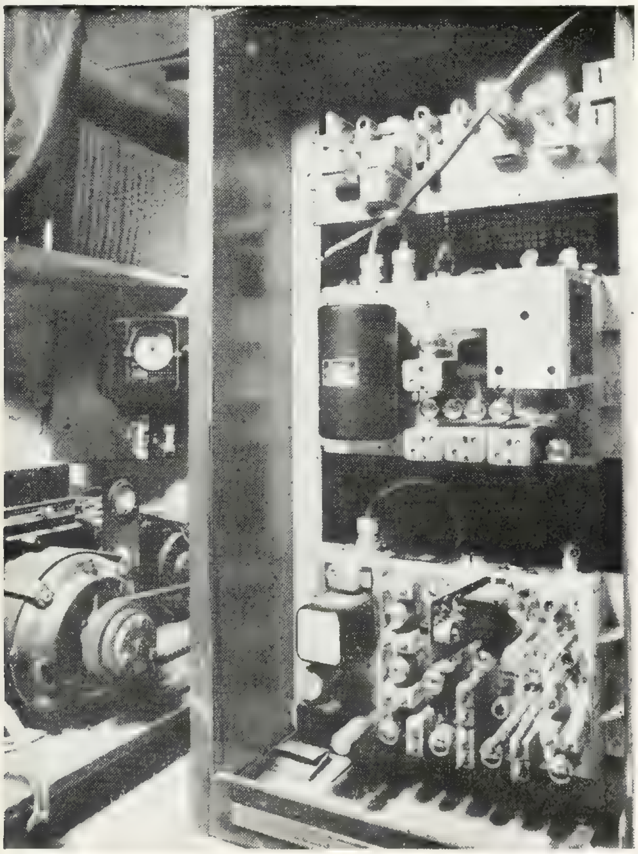
Other Colorado Systems

OTHER RADIO SYSTEMS of the Mountain States Company in Colorado are those providing telephone service to Bonny Dam, on the Republican River, to the town of Anton, in the northeastern part of the state, and to Kim, in the southeastern part. The first two of these systems were established in 1949, and the Kim system in 1950.

The radio link from Bonny Dam connects with the general telephone network at the town of Burlington, about 25 miles distant.

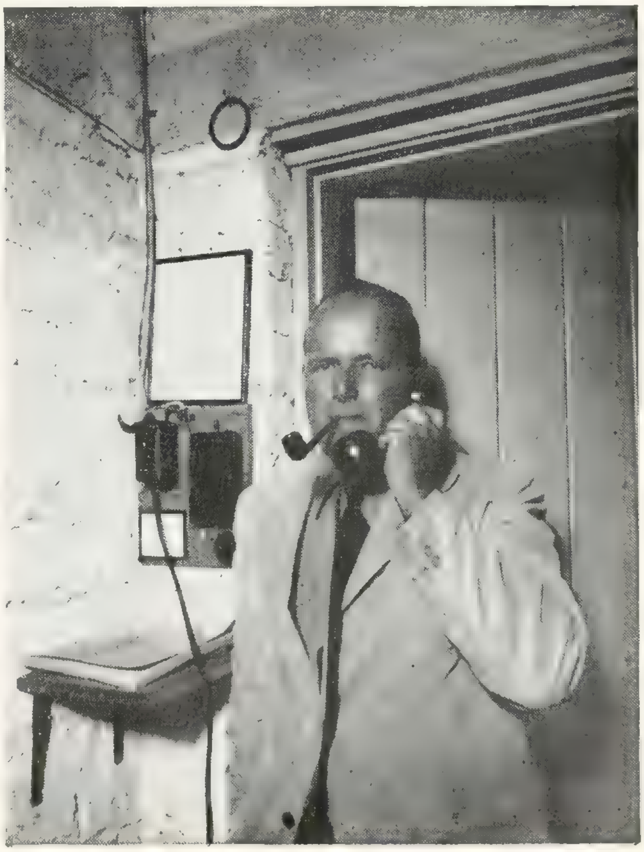
The little town of Anton, Colorado, was many miles from the nearest telephone until the radio link was established from Akron, nearly 30 miles to the north. This radio system provides two telephone circuits connecting the switchboard at Akron with that at Anton. At the same time the radio link was being built, the local telephone system at Anton was established by an organization of residents of the community under the name of the "Airline Telephone Association." This organization had the advice and help of the Mountain

Bellota Ranch, in the Santa Catalina Mountains in Arizona. Antenna is on the pole in the right background



The radiotelephone installation at Bellota Ranch

Mr. Richard Reeve, owner of Bellota Ranch, telephoning from the ranch



States Company and service started with 107 telephones.

In Kim, as in Anton, the local telephone facilities were established by the coöperative efforts of residents of the area, who formed the "Kim Mutual Telephone Association." With counsel from the Mountain States Company, they erected 65 miles of pole lines, serving nearly a hundred farmers, ranchers, and townspeople. A community dial office was established serving this area of more than 1100 square miles. The Mountain States Company provided a two-channel radio link connecting the Kim dial office with Trinidad, Colorado, 65 miles to the west.

The radio station at the Kim end of the link is located on the outskirts of the town, where the antennas are supported by 90-foot poles. At the Trinidad end, the station is located on a high butte at the northern edge of the city, known as Simpson's Rest, where George Simpson, pioneer and Indian Scout, is buried.

The Kim-Trinidad radio system is believed to be the first one used to connect an unattended community dial office with the nationwide telephone system. It provides, for this purpose, the same features as are usually provided by wire circuits. The operator at Trinidad dials telephones in the Kim area directly, the dial pulses being transmitted over the radio link in the form of spurts of tone.

Providing Temporary Service

RADIO FACILITIES of the type used to serve remote communities are quickly and easily installed, and can be moved to new locations when they are no longer needed where they are. For this reason, they have been used to provide telephone service temporarily to well-drilling operations and geological explorations.

The Standard Oil Company of California is undertaking to "prove in" a new petroleum field in Utah. When they asked, last year, for telephone service to Johns Valley and Muley Creek, in this new field, radio was again the answer to the problem. Muley Creek is about 90 miles east of the town of Panguitch, and 77 miles from the nearest telephone lines. Located near highly-colored Bryce Canyon, this area is beautiful to view, but it offers many obstacles to the construction and maintenance of pole lines. In this case, owing to the distance to be covered and the nature of the terrain, a "two-hop" radio system was necessary. Escalante Mountain, 9300 feet high, provided the location for the intermediate or "relay" station. This station, a little brother to the type of radio relay stations used on the Long Lines transcontinental radio system, connects Panguitch with both Muley Creek and Johns Valley.

There are numerous other radio installations providing telephone service to remote points. The Mountain States Company has another 35-mile system serving the town of Ekalaka, in southeastern Montana. The Pacific Telephone and Telegraph Company is using such a system to provide telephone service to Timberline Lodge, on the slopes of Mt. Hood in Oregon. The Bell Telephone Company of Nevada is providing telephone service by radio to the gypsum industry in the vicinity of Gerlach, in western Nevada. And

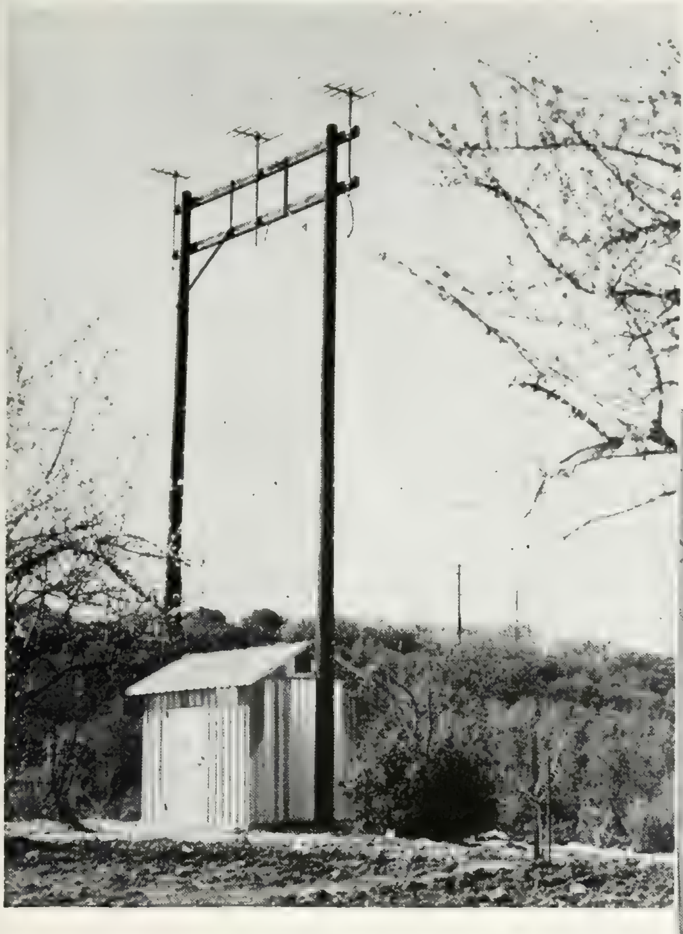
Antenna installation at one of the farms served by the Cheyenne Wells rural radio system

The telephone central office at Cheyenne Wells, Colorado, showing the antenna poles for the rural radiotelephone system. The transmitting antenna is at the left. The double antenna, at right, is for receiving

Above: Trinidad, Colorado. The radio station of the Trinidad-Kim radiotelephone circuit is located on Simpson's Rest, the butte seen in the background

Right: Radiotelephone station on Simpson's Rest, Trinidad, Colorado

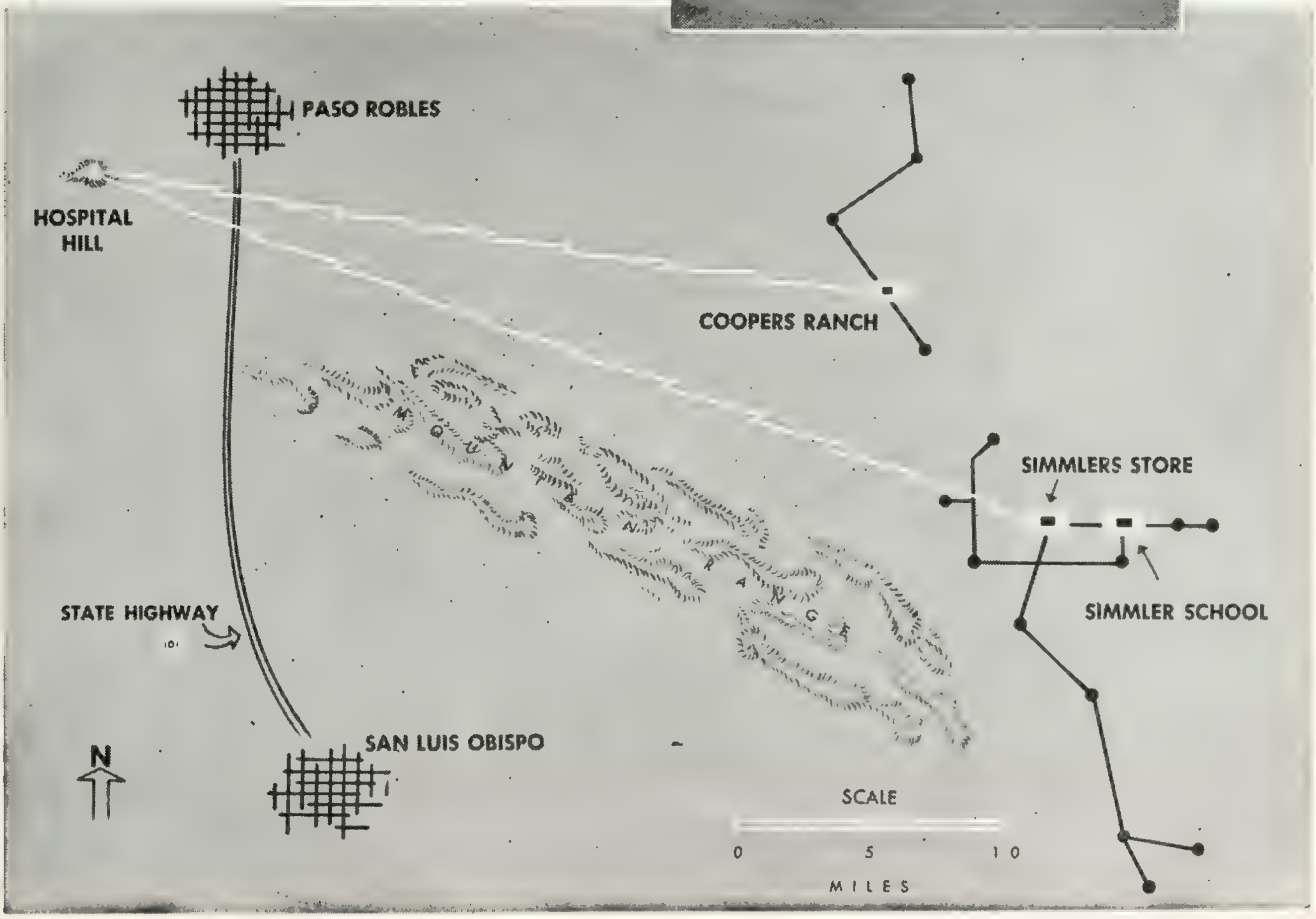
Left: The antennas of the Kim radio station rise 90 feet above the fields near the edge of town. Right: Sheriff Levi Jones, Vice President, Wire Chief, and Trouble Shooter of the Kim Mutual Telephone Association, talks to editor Victor L. Waters of the "Kim Country Record"



Left: The radio station on Hospital Hill near Paso Robles, where telephone conversations bound for the Carrisa Plains area take to the "air"

Below: Roland Cooper, Carrisa Plains rancher, making the first radiotelephone call from the public telephone booth at Simmler's store last March

Below: Location of the radiotelephone system serving the Carrisa Plains area



Erecting the antennas for the radiotelephone station at Anton, Colorado. This station provides two telephone circuits connecting with the Bell System wire circuits at Akron, Colorado, nearly 30 miles to the north

This radio repeater station on the 9300 foot summit of Escalante Mountain carries telephone messages to and from a new petroleum field in a remote section of Utah

Specter Mountain, Nevada, is connected with the nation's general telephone network through a radio link to Death Valley, California.

In some cases, two or three telephone circuits are obtained from a single radio channel by the use of carrier terminal equipment of the "H" type, such as is used on open wire lines. In the case of the Mt. Hood system, this method is employed to provide, by means of one radio channel, three telephone circuits. Two radio channels provide a total of five telephone circuits on the Specter Mountain system.

The latest installation of the Pacific Company is a three-channel system serving the ranch area of Carrisa Plains, near Paso Robles, California. From a radio station established on Hospital Hill, near Paso Robles, a two-channel radio link connects with Simmler's store, on the Plains, 40 miles distant, and a somewhat shorter single-channel link serves the Cooper ranch. Separate radio equipment is employed for each channel in this system. Wire line extensions from Simmler's store and Cooper's ranch serve other locations on the Plains. The three radio circuits terminate on the telephone switchboard at Paso Robles, and calls to and from the telephones in the Plains area are handled much the same as with any other toll station.

Installations in the East

Not all of the radio installations of this sort are in the west.

The Chesapeake and Potomac Telephone Company installed a radio system connecting Tangier and Smith Islands, in lower Chesapeake Bay, with the mainland through a station at Crisfield, Maryland, in February of 1941. This radio system, which ended an era of isolation on these islands, is still in regular service and provides the islands their only telephone connection with the mainland.

The New England Telephone and Telegraph Company has also established radio links serving islands in its territory.

In addition to radio systems serving islands in New England and the Chesapeake Bay area, there are a number of installations in service on eastern overland routes. The Bell Telephone Company of Canada has installations in both Ontario and Quebec. The New England Company has a system serving a location on the slopes of Mt. Washington, in New Hampshire; and the Southern Bell Telephone and Telegraph Company has an installation in North Carolina serving the town of Shallotte. Two of the Canadian installations are equipped with carrier terminal equipment to provide additional circuits.

Several Bell System companies have made radio installations paralleling open-wire lines, to provide added circuits. Since radio circuits are subject to hazards quite different from those affecting wire facilities, this diversification of facilities provides added protection against service interruption.

There are installations of this type in Pennsylvania and Illinois, and recently such a 3-channel system has been used by the Northwestern Bell Telephone Company between St. Cloud and Little Falls, Minnesota. In this installation, which employed carrier equipment, the radio and carrier equipment were packaged in separate compact cabinets, making the radio stations relatively portable so that they can be moved to other locations.

TELEPHONE ENGINEERS regard radio as simply another tool, another transmission method, to be used when it is the most advantageous method, all things considered, at the time new facilities are to be provided. It has taken its place alongside the older and better-known transmission methods. It is finding increasing use, not only on the main thoroughfares of communication, but also off the beaten path. It has an important rôle in bringing telephone service to out-of-the-way places; and as research and development unfold new techniques, the part that radio plays in serving rural and remote areas may be expected to increase.

Bell System Companies Win Safety Award

The Award of Honor of the National Safety Council was presented to the Bell Telephone Companies at an impressive ceremony held at the headquarters building of the A. T. & T. Co. in New York on October 6, 1952. The award, the highest honor which the Council can bestow, was in recognition of the telephone companies' outstanding safety record during 1950 and 1951. A plaque was presented to a representative of each Company by Ned H. Dearborn, President of the Council, who commented that the communications industry, of which the telephone companies are a substantial part, has topped all major industries for the past eight years in safety performance. Cleo F. Craig, President of A. T. & T., in responding to Mr. Dearborn, accepted the award not as a laurel on which to rest but as "an incentive to further progress." Mr. Craig credited the improving program over 21 years with preventing 700 fatalities and 57,000 injuries—based on a comparison of the safety performance since 1930 with a base period of 1926–1930. (See also "Bell System Safety Record Continues to Improve" in this MAGAZINE for Winter 1951–52.)

Bell System Requirements for This Scarce Metal in 1952 Are Less Than Half of Those for 1941, While Production Of Telephone Equipment Has More Than Doubled

Nickel Conservation in The Bell System

Research, manufacturing, and operating all contribute to the Bell System's major achievement in the conservation of the indespensable metal nickel; *and Bell Laboratories, Western Electric, and A. T. & T. joined in providing for the information of the National Production Authority the statement reprinted below. System people everywhere will take pride in reading of so effective an effort.*

EDITOR

WHEN YOU pick up your telephone and dial a number, your finger points directly at Bell System nickel conservation and substitution achievements.

Just below your finger tip on the dial number plate, for instance, is a ceramic coating, and under the coating is a layer of nickel, placed there in manufacture to help the ceramic material adhere securely. Hidden more deeply in your telephone instrument are more than two dozen parts in which nickel is important.

Beneath the receiver cap next to your ear is an assembly of sound-producing parts. Some of these are made of Permalloy, a nickel alloy with special magnetic properties developed by the Bell Telephone Laboratories specifically for use in the telephone plant. Permalloy is also at work in the armature in the base of your combined handset.

As you dial your number, contact springs of nickel silver go into action in the dial mechanism. The pulsating flow of electric current between your instrument and the central office activates relays in the far-off office. These switching devices, which automatically connect you with the party you want, have springs made of nickel silver. They are used by the millions in the Bell System. As many as fifty to one hundred thousand relays may be installed in a single large crossbar exchange.

Your voice makes its electrical journey through the complex telephone network at the speed of light and is reproduced by the distant receiver with clarity, strength, and naturalness. To achieve this remarkable result—a result so commonplace that Americans rarely give it a second thought—your voice is helped in its travels by such devices as loading coils, which, among other tasks, reduce signal distortion. The cores of these coils are made of Permalloy.

The successful trip your voice makes is dependent, too, upon the services of innumerable electronic tubes—of which, in all the Bell System, there are approximately one and a half to two million. There is nickel in various parts of all these tubes.

All of which is an incomplete, even sketchy, picture of the uses of nickel in the Bell System. Actually, the metal has become so completely integrated into the telephone system that it is virtually impossible to find apparatus in which nickel is *not* playing a significant role.

The National Nickel Shortage

Some of the same properties which make nickel practically indispensable to the Bell System—itself a national defense asset—make nickel indispensable to the national defense efforts of other industries.

Defense requirements for equipment and material cannot be met satisfactorily without nickel. The aircraft industry, for example, uses alloys of high nickel content in building all types of motors, including jet engines and rocket motors. Large quantities of special nickel steels are also needed by the chemical and petroleum industries for the expansion of defense supporting facilities.

The demand for nickel in 1952 in the United States, according to the National Production Authority, is about double the available supply, and the situation is likely to get worse before it improves. Consumption

Your finger points directly at Bell System nickel conservation and substitution achievements of nickel this year for civilan and military purposes will probably be greater than in any year since 1948, when about 187 million pounds were used, of which only a small amount was devoted to military production. Since that time military requirements have increased precipitously and civilian allotments have been cut drastically. It is estimated that in 1952 less than 80 million pounds of nickel will be available for civilian purposes.

How Does the Bell System Fit into This Picture?

The current nickel shortage was first anticipated about the middle of 1950, and the Bell System launched a program immediately to cut down the amount of nickel used in the System.

In 1952, 1,888,100 pounds of nickel are called for to do the Bell System manufacturing job, and about one third of the requirement will be obtained from scrap saved by the Bell System. This quantity reflects recent substitution and conservation efforts. Since 1950, the Bell System has reduced its annual requirements for nickel by 984,000 pounds—or about 34 per cent. Without such savings, Bell System need for nickel in 1952 would amount to 2,872,300 pounds.

The reduced amount needed by the Bell System in 1952, however, reflects much more than current substitution and conservation work. It also reflects many improvements in design and advances in manufacturing techniques made in the last decade for operating or economy reasons. The result is that in 1952, requirements will actually be 241,900 pounds less than were the requirements for 1941, *even though Bell System production for 1952 will be over twice as large as in '41.* If the Bell System were still using 1941 designs and processes, about 4,750,000 pounds of nickel would be consumed annually at today's going rates!

A telephone dial mechanism—viewed from underneath. Four of the six contact springs, as well as three parts of the governor, are made of nickel silver

Nickel has always been used as sparingly as possible because nickel has always been an expensive metal. Economic considerations are basic in the Bell System policy of supplying the best possible telephone service at the lowest possible cost.

World War II and Today

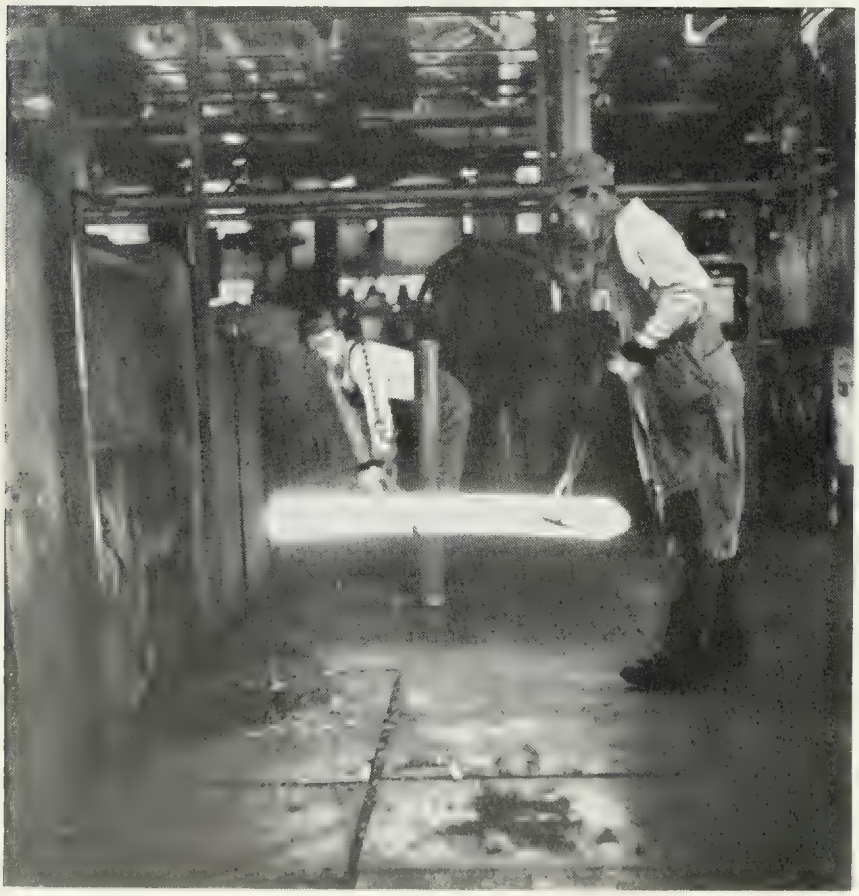
The first big nickel pinch experienced by the Bell System came in 1941–42. Drastic reductions in the use of the metal were made necessary by World War II military needs. Before the end of 1942, substitutions and savings were made which, along with some curtailment of production, reduced Bell System use of nickel by more than half.

This was a remarkable achievement. But, of necessity, many of the substitutions were temporary, emergency methods put into effect quickly and with considerable improvisation. The World War II experience, and many studies made since, indicate that if substitutions are not made wisely, the quality of telephone service may be threatened, to say nothing of maintenance and replacement problems which will crop up later and be most uneconomical and difficult to deal with.

Today's situation is complicated by the fact that the System's long-time effort to reduce consumption of nickel has been unusually successful. The Bell Telephone Laboratories and Western Electric, the System's manufacturing unit, are finding it more and more difficult to discover places where the use of nickel can be safely reduced or eliminated. The fact is that the Bell System is now using proportionately less nickel for new plant than ever before.

Save! Substitute! Salvage! Today's Conservation Efforts

SINCE 1950, the Bell Laboratories and Western Electric have gone over the Bell System plant again and again virtually with a fine tooth comb. No part of any piece of apparatus, regardless of how insignificant, has been overlooked if nickel is involved. Springs, switches, screws, brackets, terminals, dial number plates, coils, pole pieces—literally hundreds and thousands of items—have been studied painstakingly.



A white-hot ingot of Permalloy being guided into a Western Electric hot-rolling mill

Substitutions, however, cannot be decided upon and put into effect over night. The process requires the coöperation and skills of a great many Bell System people, rearrangements of manufacturing processes, and equipment redesign.

When substitute materials have been selected or developed and availability determined, they must be engineered into product designs. Trial lots of the product, and sometimes the material itself, must be manufactured and tested and specifications prepared. Manufacturing drawings, methods, and tools have to be revised. Production samples need to be studied, tested, and manufacturing difficulties ironed out. Once the products are in service, field performances must be studied. All this has to be done for every item.

In studying the problem of substitutions, the task is approached from the standpoint of how the metal is employed in the telephone system. The use of nickel divides quite naturally into a number of categories. The largest uses of nickel are in magnetic alloys, in nickel silver, in electroplating, and in purchased alloy forms. Of these categories, the Bell System uses more nickel by far in special purpose magnetic alloys than in any other.

Metal scrap like this is processed in Western Electric's metals mill. Nearly one-third of the nickel content of all nickel silver and magnetic alloys used currently by Western Electric is recovered from its own scrap

MAGNETIC ALLOYS

Estimated savings for 1952: 371,000 pounds of nickel

Approximately 60 per cent of the nickel the Bell System needs for 1952 will be used in magnetic alloys—a total poundage of nickel amounting to more than 1,100,000 pounds.

Much of it will be used in loading coils, which are placed in circuits to aid transmission. But much more nickel would be required if it weren't for the fact that loading coil cores have been the subject of intense research and study for many years. Starting as long ago as 1941, some loading coils were redesigned to use only half as much Permalloy in their cores as before. In the intervening years, improvements have been made steadily in the uses of Permalloy. The result has been that in 1951 almost two and one-half times as many loading coils were produced per pound of nickel as in 1940.

Of the 371,000 pounds of nickel which will *not* be used in magnetic alloys in 1952, 276,000 pounds are being saved by the use of silicon steel for Permalloy in the cores of some transformers, retardation and repeating coils, and also in the HA-1 receiver pole pieces. Another sizeable saving of 89,000 pounds is resulting from the use of magnetic iron for Permalloy in two types of ringer cores.

NICKEL SILVER

Estimated savings for 1952: 474,000 pounds of nickel

Nickel silver—an alloy of copper, nickel, and zinc without any silver in it—is employed throughout the Bell System plant. It is used in thousands of items, principally in contact springs. It would be difficult—if not impossible—to make a telephone call anywhere in the United States without the help of this alloy.

Before World War II, nickel silver containing 18 per cent nickel became the standard for many contact springs. It was adopted because it was considerably superior to metals used up to that time. Recommending it were such characteristics as excellent springiness, good contact-welding properties, relatively fair conductivity, and resistance to corrosion.

Since 1950, however, 18 per cent nickel silver has become virtually an alloy of the past so far as telephony is concerned. Bell System research and engineering succeeded in developing a new alloy containing only 12 percent nickel which can be used for springs of certain relays, switches, jacks, and numerous other items. Thanks to this, nickel in the Bell System is now being saved at an annual rate of 279,700 pounds.

Because of the large savings which have been made through the use of 12 percent alloy for contact springs, the National Production Authority has recommended its use for this purpose throughout the entire communications industry. To make this possible, the manufacturing information developed by Western Electric, both for making the new alloy as well as its application, plus a great deal of Bell Laboratories data concerning this alloy's physical characteristics, all of which is new, has been made available to other manufacturers.

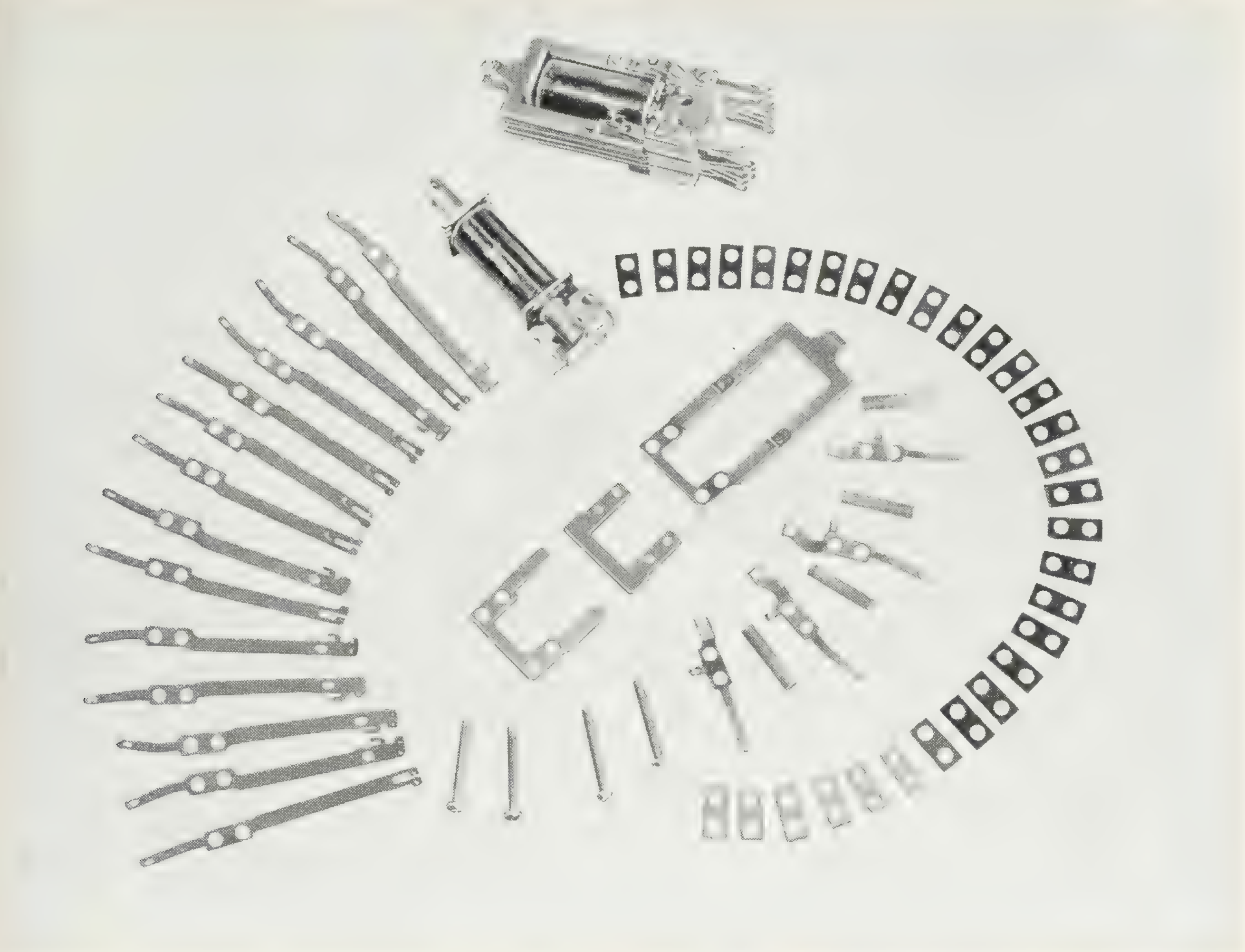
In the cases of a few parts, it has been found that nickel silver can be completely abandoned. Brass has been substituted in certain switch and relay springs, in relay screws, and the like, to save nickel at an annual rate of 168,300 pounds. Another 16,700 pounds is not being consumed each year because zinc plated steel has been adapted for certain relay shells, apparatus brackets and other parts.

NICKEL PLATING

Estimated savings for 1952: 13,300 pounds of nickel anodes

Compared to the quantities of nickel used for other purposes in the Bell System, nickel used for plating doesn't amount to very much. Nickel plating is, nevertheless, very important for functional reasons where problems of resistance to corrosion and wear are involved.

Substitutions already in effect have cut the amount of nickel normally required by the Bell System for plating by about 20 percent. Zinc, chrome, or copper plating is being used in some cases. In others, the nickel finish has been omitted entirely or reduced in thickness. The latter method is saving about 7,500 pounds of nickel anodes in the production of dial number plates. The nickel coating (applied before the ceramic finish) has been reduced in thickness by at least 50 percent.



A common Bell System relay shown with the many parts needed to make it. Springs are of nickel silver, core is of Permalloy, and nickel is used in the finish applied to the armature and to the core mounting bracket. This relay's efficiency and long life is dependent in large part upon nickel

Investigation of plating as applied to relay cores and armatures has also been one of the engineering studies under consideration. Many years of development work has resulted in perfecting these devices to operate hundreds of millions of times without attention. Substitutions for nickel plating involve questions of operation and release of the relays, problems of corrosion and wear, and the possibility of sticking of armatures. Nevertheless, Western Electric is realizing an annual saving of 3,400 pounds of nickel anodes by closer control of the thickness of the nickel coating on these parts.

OTHER ALLOYS

Estimated savings for 1952: 125,900 pounds of nickel

There are a number of alloys purchased by Western Electric in sheets, strips, and other forms suitable for manufacturing.

One of the more important is stainless steel, which is employed for parts which must be exposed to corrosive materials, atmospheres, or underground conditions. The strength and stability of these steels make them particularly valuable for apparatus parts and hardware used by the Bell telephone companies.

Loading coils by the hatful with cores of Permalloy. Two and one-half times as many coils are produced today per pound of nickel as in 1940

Nevertheless, Bell System requirements for nickel-bearing stainless steels have been cut by about 70 percent. These results have been achieved in part by wide use of chrome stainless steel or ordinary steel, zinc-finished.

In at least one instance, the usage of nickel-bearing stainless steel has been increased to save nickel. This occurred in the instance of a part in the magnetic circuit of the receiver of the new 500-type handset which was originally designed to be made of an alloy containing 76.5 percent nickel. Engineering studies, however, revealed initially that stainless steel containing 25 percent nickel could be used and then, later, that stainless steel containing 8 percent nickel might be employed. The potential annual savings in nickel in 1952 by this substitution alone comes to 78,500 pounds.

THE SUCCESS of the Bell System program to date has been due to a willingness to concentrate an unusual amount of research and engineering upon nickel and a willingness to make savings here, there, everywhere in the System, even though some savings may amount to no more than a few hundred pounds. This work has been so thorough that scarcely any opportunities remain for making new savings without seriously impairing telephone plant.

The facts as presented in the preceding pages are merely the highlights of the Story of Nickel Conservation in the Bell System. The complete narrative, with all details and with proper emphasis upon research, engineering, and manufacturing, is too complex to be told in a few pages.

However, this big story is in the records and, in a nutshell, this is the way it reads:

Bell System nickel requirements in 1952 are actually less than in the final pre-war year, 1941, despite the fact that production of telephone equipment has more than doubled.

Bell System Presidents on the Atlantic and Pacific Coasts Emphasize the Financial Difficulties with Which Telephone Companies Are Faced in an Inflationary Period

The Significance of Inflation For Bell System People

The following paragraphs are from addresses by Presidents Mark R. Sullivan of The Pacific Telephone and Telegraph Company and Keith S. McHugh of the New York Telephone Company on different aspects of a common problem which has serious implications for all telephone people. Mr. Sullivan spoke before the California Independent Telephone Association on June 20 and Mr. McHugh before the New York State Chamber of Commerce on June 5, 1952.

EDITOR

I. Public Interest Profit

Mark R. Sullivan

THE ANNOUNCED SUBJECT of my talk is "Public Interest Profit."

I made about the same talk last month before the California State Bankers' Association. . . . I told them that we had a strong bond of interest. It was money. They have it . . . and we want it. I told them also that I had a complaint to make. It was about the raw material that goes into the basic unit of their business—the dollar. I don't know where they're getting their stuff, but frankly it isn't good. Their merchandise shrinks. That's right . . . shrinks. . . .

If anyone reduced the fat content of our milk, we'd say it was skimmed. If anyone reduced the virgin wool content of our clothes, we'd call it shoddy. But when the value of the dollar is cut in half, we call it inflation; as though something was put in. Maybe a lot of water has been put in, but the important thing is the value that has been taken out. And that is the basis of my complaint.

But whether we are satisfied with the stuff that the banks are dishing out, politely classified as dollars, we in the telephone business must get it somehow—in a constant flow. It is the price of telephone growth and improvement on the Pacific Coast.

Balance the Line

People speak of the diluted value of the dollar as inflation.

But it is not inflation in the overall that does the damage. The principal damage is done by the inequalities of inflation which throw our economic system out of balance.

You and I have known it for some years. We learned it the hard way. Others have been joining us, until now there is a great chorus of protest going up over the land. The chorus is, however, badly out of tune.

In the background is the recurrent theme—a chant to hold the line. But other voices ask where is the line that is to be held. And there are wails of doubt as to who is to do the holding. And if there is a line that is going to be held, the man who finds himself at the end of the line is going to be badly hurt.

In truth, the problem of inflation is not so much that the economic line has moved. The great problem is that what was once a balanced line has become an unbalanced one. Parts of the present line have become badly swollen where it ought not to have been swollen, festered perhaps with mink coats, five percenters, and silk shirts. Other sections of the line are badly constricted, causing weakness in vital spots—well—like telephone prices. . . .

This inflation hasn't been a free and open inflation in which everyone kept step. It has been a manipulated inflation in which some were controlled a little and others a lot and some not at all. So the thing is not like a snake's back, and there are a lot of us who have no enthusiasm for holding this reptilian line unless or until it gets straightened out.

Dollars a Measure—Not an End Product

Perhaps we should get on common ground as to what inflation is. There are many definitions. One gaining general acceptance is: "too many dollars chasing too few goods" and I think that's as good as any.

It's hard to realize that having too many dollars in circulation can result in anything bad. For it is easy to lose sight of what dollars actually are.

We are too often inclined to think that dollars are an end product in themselves. They are not. They are just a measure of an end product—a measure of value. Dollars or lira or francs or rupees or pounds, or whatever you want to call them, are merely tickets that represent something else. That something else is productivity. As soon as dollars that are not matched by production start flowing into the economy, trouble is brewing.

I will not be foolhardy enough to detail my views as to all that has contributed to creating inflation. Nor will I bore you with my opinions of the Government practice of failing to redeem its IOUs in real value—a practice which goes, I believe, under the polite term of "monetizing our public debt."

I wonder sometimes what might happen if we in the telephone industry were to monetize some of our debt by paying it off in crisp new paper that didn't mean anything. If we tried it I know you and I couldn't get away with it. But we don't hesitate to let our government get away with it. Under our surprising double standard, we allow our own government—over which we claim control—a set of business morals we would not condone among ourselves as individuals.

You know, no one really minds inflation until it catches up with him. In some cases inflation grabs hold at the very start; in others, there is enough of a lag between cause and effect so that people forget or fail to see the terrible danger that lurks within the wage-price spiral or in the other symptoms of the inflationary disease. . . .

Before World War II, for each $10,000 of new investment money we could add 59 telephones to our operations. We could install the telephones, build the buildings, construct the poles and wires, add the central office switching equipment and do all the things necessary to make those telephones work. Today, for each $10,000 we can add only 23 telephones. In 1940, 5.9 telephones per $1,000; today 2.3 telephones. Two telephones are now expected to do the work of about six. It's just too much to accomplish. . . .

Loss of Balance May Destroy Economic System

Lenin is reported to have said in the early 20s, "Some day, we shall force the United States to spend itself into destruction."

I'm sure you've all seen or heard that quotation in recent months. I might say I tried to get a check on that quote—where, when, under what circumstances—but so far my students of Lenin haven't been able to track it down. Perhaps I've got the wrong students, or maybe Lenin never said it. I mention this only because I want you to know I give you research with my talk. Anyway, if he didn't say it he might have. Certainly his present-day disciples make it clear they wish to do just that.

As a matter of fact, it isn't necessary to spend ourselves into destruction. All that is necessary is to start the procedure and throw the economic system badly out of balance. That's the quickest and surest way of reaching destruction.

Telephone prices are under Government regulation. If the regulation works well, it would maintain equitable prices for telephone services that will keep our charges in step with prices generally so as to insure a free flow of investment money. Our pricing hasn't worked out that way. Our costs of doing business have doubled since 1940; our prices have increased only about a third.

In a situation of this kind we should look not only to increased revenues but to decreased expenses. It means we must sharpen our pencils and our wits to make all wise economies. And this we have done. But when we are confronted with costs which have doubled, it is asking too much to expect that the difference can be made up by economies....

Plea for Good Earnings Not Self-Serving

My plea for good telephone earnings is not a self-serving one. Good earnings for our business are good for everybody involved in the telephone business—and just about everybody *is* involved in the telephone business these days.

Good earnings means the kind of profit that enables us to do more than just get by. Good earnings provide investors with sufficient incentive and confidence in the future so that they wil keep on putting all the capital into the property that can make for better and cheaper service.

What I am asking for is a *public interest profit*—one that enables the industry to plan and act for the long pull. It certainly is in the public interest to do an economical job by avoiding the waste of short-term month-to-month planning and building which is all that can be done with an inadequate return. We ask for a good profit so that we may make tomorrow's telephone bill buy more and better telephone service for our customers. We want the chance to do our utmost to develop the Coast and to serve its people without the restraint of inadequate preparations for the future. Good profits in our business do not mean high prices. As a matter of fact, reasonable profit results in lower telephone prices than would otherwise be necessary.

The way to good service and long-range economy is to plan to meet all public demands with an adequate supply of the best possible equipment. You and I know that it is cheaper in the long run to put in cables with enough low-cost circuits to take up the growth of five years than it is to string single circuits year by year as growth demands. But if there is not money enough to put in the cables, the single circuits become as inevitable as they are uneconomical. . . .

Increases in Telephone Rates Not Inflationary

I AM against inflation, yet I point to the need of increased telephone prices. That may seem inconsistent but I don't think it is. In the first place, I do not agree that increases in telephone prices are inflationary at all. I'll enlarge upon that later. But apart from that—whatever is necessary in the way of telephone prices in order that we may keep on giving people of the Pacific Coast all the telephone service and the kind of telephone service they want has to be done regardless of what anyone thinks about it in its inflationary aspects. The telephone industry must not be depressed and made weak, because here is an industry that adds to the country far more through the service rendered than it takes out in the prices we need to charge.

I say that I do not concede that an increase in telephone prices need be inflationary at all. Let us get back to an accepted definition of inflation: too many dollars chasing too few goods. Under that definition you cannot have inflation except by (a) increasing the number of dollars or (b) decreasing the amount of goods, or (c) both. If you do not change the total number of dollars or credit in circulation, an increase in telephone prices may mean there will be fewer dollars for other things, but over all it could not be inflationary. On the other side of the equation—the production side—more dollars flowing into telephone prices would increase productivity, and to that extent reasonable telephone prices would retard inflation rather than contribute to it.

Crippling Telephone Service Sure Way to Economic Unbalance

WEAKENING the telephone system would be a leading example of how to throw the economic system out of balance. Telephone service is one of the principal factors of effective productivity in America. If telephone service is retarded by unduly restricting the flow of money into the business, one of the most effective weapons in the industrial arsenal of democracy will be damaged.

We want *only* what is in the public interest. And it is in the public interest that our prices be adjusted more in line with our costs. Actually, telephone service is cheaper today—in terms of real value (baskets of tomatoes, buckets of milk, tons of steel)—than ever before.

But it is necessary in the public interest to adjust telephone prices more in accord with the purchasing power of the dollar. We can adjust them *downward* if the traditional purchasing power of the dollar can be restored, but we must adjust them *upward* if it can't. And there is still little evidence that inflationary forces are being firmly, finally checked.

The only way we can continue to do our full job in the public interest and in the interest of all is by keeping a steady flow of new investment money into the business. To accomplish this we must have fair prices. If we are to get them, we must appeal to our customers, our employees, to everyone, in fact, for their understanding and help with our problem. An industry that bears the shackles of an inadequate profit cannot do its best. In this country, with our dangers of today, our challenges of tomorrow, only the *best* telephone system is good enough. So, the need for a good telephone profit is not *our* need alone: a good telephone profit is a *public* need. And we ought to keep right on saying so—telling everybody, in fact, who will listen. And a surprising lot of people do listen—when we talk. I believe that we are heard, that we are believed—for what we speak is a vital truth that creates belief simply because it is so. I propose that you and I keep on telling the telephone story. We have a proud record of acting in the public interest. We must also speak in the public interest.

II. Inflation and Your Telephone

Keith S. McHugh

DURING this last decade we have been subject to a kind of triple squeeze. The squeeze of rising operating costs, wages, materials and supplies—the squeeze of soaring taxes—and the squeeze of high construction costs.

None of these phenomena is new, since all in business feel them in greater or lesser degree. Our squeeze in operating costs, especially wages, is heavier than most because we have a relatively higher labor factor than most industries. The squeeze in taxes is familiar to all, but it is worth mentioning here because the taxes we paid last year—$110,000,000—are now over three times what they were in 1939. Our telephone users also paid $92,000,000 in excise and sales taxes. Thus the tax bite per average telephone per month is now $3.20 compared with about $1.40 before the war. This is equivalent to three-fourths of our wage bill and is over four times the amount of our dividend. Thirty-two cents out of every dollar the New York user paid for his telephone service in 1951 went for taxes. No major industry except distilling and tobacco carries a heavier burden. . . .

THERE has been no disposition on the part of the Public Service Commission, or of most Commissions throughout the country, to reject increases in costs of operation and taxes as a basis for higher rates, where the company showed that these increases have adversely affected earnings. The difficulty on this point has been the delay, the time lag in getting the required adjustment in rates. At best the present-day rate case is a long drawn out and laborious process, at worst the patient may be very sick indeed before relief is granted.

While increases in operating costs and taxes (the first two big squeezes) have been recognized by most regulatory authorities, *the third squeeze —the high construction cost of plant replacement and expansion—has not generally been recognized.*

Here the prevailing practice has been to rest upon a formula which has been in wide use for the last 20 years or so. For convenience, we call this the "original cost less depreciation" formula. This concept assumes that the original cost of the property, less accrued depreciation, represents the rate base on which the company should be allowed to earn. To this amount, of course, is frequenty added something for working capital, but for convenience I will pass over this item as it is small in comparison with the plant.

Working a Severe Hardship

I WILL NOT GO into the merits or demerits of this historic formula as it affected telephone rates and earnings during the early part of the last 20-year period when costs and prices were reasonably stable. But it is at once apparent that it works a severe hardship during periods of rapidly rising costs. I can illustrate with our own case. Our company has property on its books which cost around one billion six hundred million dollars. About one-half of this plant was built at pre-war prices and most of the remainder at post-war prices. We know as a fact that replacements of pre-war plant—much of this will have to be replaced within the next ten years—will cost up to twice as many dollars as it cost when it first went on our books. In other words, a dollar today will build only a little over one-half of the revenue producing telephone plant that it built before the war. This is equally true as to growth plant; that is, a dollar expended for growth today will build not much more than one-half the plant that it built before the war.

This phenomenon also appears in many other businesses. But there are two big differences. First, we happen to require a disproportionately large plant investment to produce a dollar of telephone revenue—our plant dollars turn over only once in three years in relation to sales. Second, most other industries have been able to increase their prices and realize earnings sufficient to finance a large part—if not all—of their replacement and expansion out of earnings.

Examples of successful companies which have been able to do this are legion. And the stockholder of such companies has not fared too badly. Dollar earnings have increased greatly. Dividends could be, and were, increased. Larger retained earnings met the needs for additional capital. On the average, the dollar dividends of Dow Jones Industrials, for example, have more than doubled during this period and their market values and book equities are about twice what they were. But the telephone company's dividend has not increased, there has been no appreciation in the market value of its stock and its book equity shows only a small increase. Finally, the telephone company has been able to meet only a minute proportion of its postwar capital needs from earnings.

Our problem points up a deficiency in the conventional method of accounting for business costs.

Replacing Low-Cost Plant at High Cost

THE FACT IS that standard systems of accounting for depreciation provide a wholly inadequate measure of the capital consumed, because they do not reflect the effects of high costs of new construction to replace low cost plant. There is a real additional cost of capital consumption not presently reflected in expenses. Failure to recognize it may affect the integrity of the earlier investment committed to the business. Recognition of these hidden capital costs must be given so that they can be reflected in proper prices.

In short, there has been a real squeeze on the pre-war share owner of those businesses whose present earnings do not reflect the increase in investment values caused by inflation. The pre-war bondholder is, of course, squeezed as are all other senior security holders. In our case the older stockholder sees the new stockholder adding only a little more than half the telephone capacity per share purchased, but sharing equally in the earnings.

Some have urged that this plea for the older share owner seeks to put him in a preferred class, one whose equity investment would be free from the effects of inflation, except for the effect of higher personal taxes. That is not the point. Far from being in a preferred class, such share owner took all the entrepreneurial risk but in fact got no more protection against inflation than the man who bought senior securities or one who kept his money in the savings bank. It is well known that only those who have invested wisely in commodities, in farms or farming, in certain special classes of real estate, and in common stocks of companies able to adjust prices, have protected their investment and their real income. I believe that over the long pull these risks of telephone share owners must be recognized on approximate equality with those of other entrepreneurs in successful industry or such shareowners will seek the greener grass of other investment pastures. There are several ways of achieving this equality. The simplest and most logical is for the regulatory authorities to admit the obvious fact that telephone plant has a current value greater than its depreciated book cost and to permit a reasonable rate of return on this value. Only a few states now have so-called fair value statutes, and not all of those which have them follow them for rate making purposes. . . .

Keeping Our Telephone Service the Best in the World

Despite the main inflation problem which I have described, I see no reason for becoming discouraged about the outlook for our business. In the first place, I think it is healthy that we recognize the difficulty created by inflation, talk about it frankly and work hard to convince the public and the regulatory authorities of its consequences. The matter would be dangerous indeed if it were not recognized by the management or if we were loath to meet it squarely. Secondly, I am sure that if you make a careful review of the progress made by the Bell System Companies since the war in obtaining price increases in every State, you would find that considerable success has already been achieved in improving earnings, even though these are not yet satisfactory. The Public Service Commissioner today is a sincere, intelligent and honest public servant, doing his best to be fair both to the public and to telephone investors. I am confident that he will decide this issue wisely and courageously when finally convinced of its importance. Lastly, I think you can take some comfort in the fact that the business has nearly doubled in size in ten years and has continued to give more and better telephone service with only very small increases in prices. This has been possible through continuous improvement of plant and equipment by our scientists and engineers, constant improvement in methods and techniques by our operating management, and by the loyalty and devotion to the service of our thousands of telephone men and women—who are tops in my book. These are the qualities which have kept your telephone service the best in the world and they are the qualities which, God willing, will keep it that way in the future.

Anonymous Heroine

A Book Review

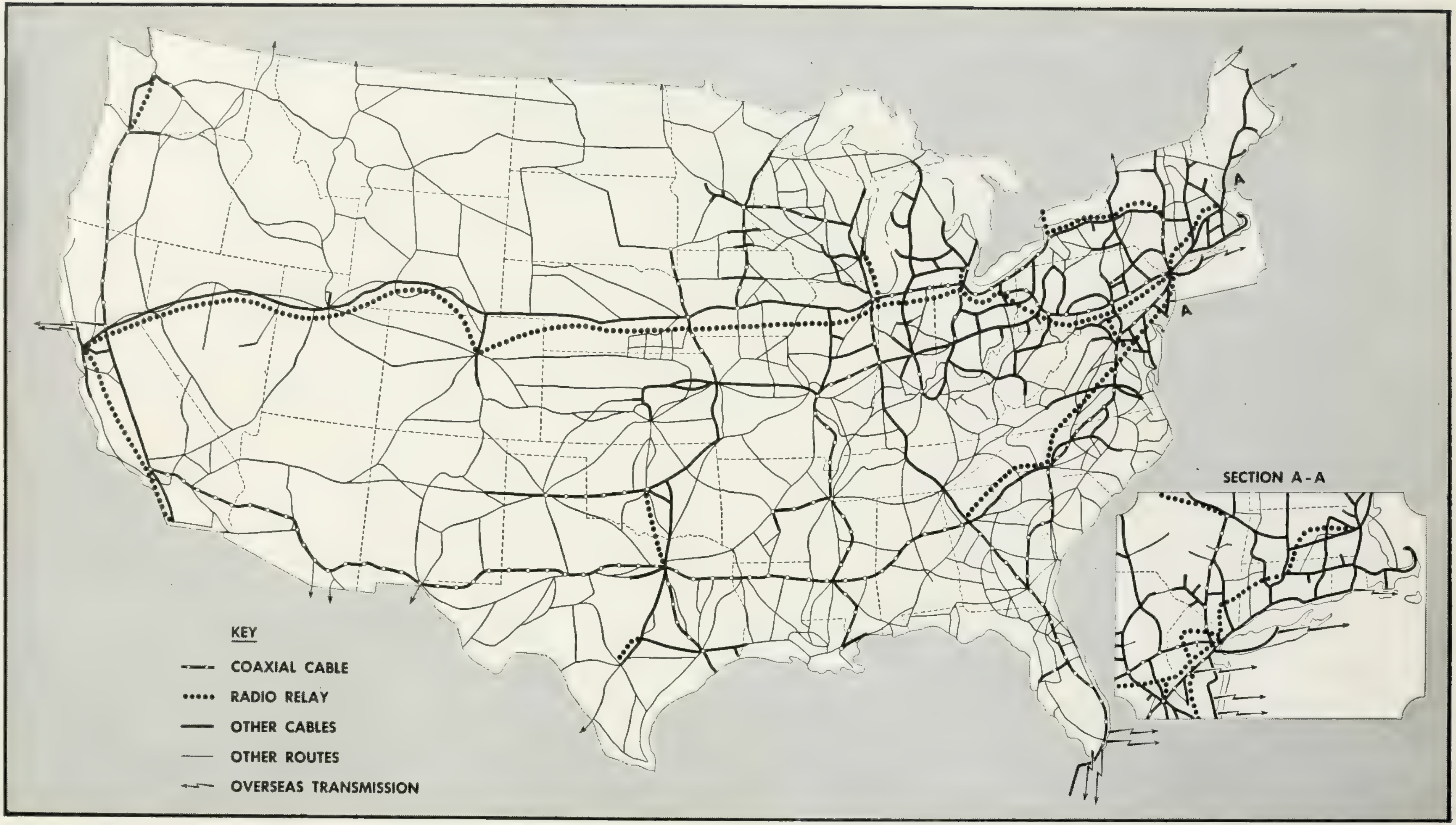
NOT JENNIFER but an overseas telephone operator is the heroine of "Passport for Jennifer," a new book by Rear Admiral Edward Ellsberg, U.S.N.R. (Ret.), published by Dodd, Mead & Company last September. For Jennifer is but a child; and it is the anonymous overseas operator whose persistent and effective handling of her circuits enables Adm. Ellsberg to overcome obstacles which threaten to halt the orphan Jennifer's voyage from England to this country for adoption. The chapter relating the day-long struggle to complete that call will be for telephone people the most interesting in the book.

Adm. Ellsberg seems to have spent a good part of his life overcoming practically insuperable obstacles—and then giving us exciting narratives about how he did it. Raising the submarine S-51 resulted in his well known "On the Bottom," and his salvage work at Massawa and then as General Eisenhower's principal salvage officer in World War II were followed by the more recent "Under the Red Sea Sun" and "No Banners, No Bugles"—to name but a few of his volumes. "Passport for Jennifer" is not in their category; for the principal obstacle he faced and vanquished, albeit by dint of extraordinary effort and ingenuity, was but official indifference and red tape.

During the recent World War, there served under the then Captain Ellsberg two salvage officers of whom he grew to think very highly: Capt. Victor Harding, an Englishman, and Lieut. George Ankers, an American. After the war, Harding returned to the sea, and Ankers established himself ashore, in the State of Washington. They kept in touch with each other, and when Harding's wife died, leaving a year-old daughter Jennifer, Mr. and Mrs. Ankers, still childless, asked to adopt her. Harding gladly agreed to this, since otherwise she would have to be placed in an institution. But British law forbids taking a child out of the country for adoption, and that happy solution to a heart-breaking problem was blocked. Recalling their former commander's resourcefulness, and knowing of his many official contacts, both men turned to Adm. Ellsberg for help, and he undertook to find a solution. How he did it, so that the child is now Jennifer Ankers, of Suquamish, Wash., is the story he tells. It is some measure of his ability as author that he makes a readable yarn out of it.

The writing is uneven, and the pace lags in places. The book is based on fact, but Ned Ellsberg is not one to let a story suffer for lack of lively telling—and anyway, exaggeration is to be forgiven in a man who actually does the heroic deeds others only read about. His ideas about the charges for overseas service are 'way out of line, for example, and a little research at the Long Lines Department reveals that not one overseas operator but seven worked on his call before it was completed. He hasn't much use for British ways of doing things, and some of his comments on this score seem unnecessarily caustic. But telephone readers will find no exaggeration in his observation, after completing a swiftly handled call from Southwest Harbor, Maine, to George Ankers in Suquamish: "There might be something, I thought, to private enterprise after all, if what it produced was companies like A. T. & T."

J. S. B.



The major toll telephone routes which criss-cross the United States

More than Forty-four Years of Bell System Experience Have Contributed To This Exposition of the Scope and the Problems of Telephone Engineering

Engineering Bell Telephone Plant

James J. Pilliod

Engineering has sometimes been defined as a profession that can make two blades of grass grow where one grew before, a sort of "one gets you two" process of the kind that has been much sought after by men in all ages. But in this electronic age, telephone engineers do better than that. For they get 16 or more telephone circuits with one pair of aerial wires, and coaxial cable systems are being tried out that produce 1800 circuits on a pair of copper tubes about the size of a pencil.

A vast amount of work broadly classified as Engineering has gone into the building and operation of the telephone plant owned by the Bell Telephone Companies. For three quarters of a century this has been an important part of the activities of these Companies—from the invention of the telephone in 1876 to the present smoothly functioning communication system representing an investment at the end of 1951 of over 11 billion dollars with operating revenues of nearly four billion dollars per year.

This plant, with that of connecting companies, provides facilities for a world-wide communication service used continuously by many millions of people, yet with each call made to order for the customer who places it. The service as a whole is an essential part of the social and business structure of the nation, and an essential element in the administration of government functions at all levels, in peace and for national defense. Some of the facts concerning the kinds of engineering work involved in constructing and operating this telephone plant, and concerning the organizations which do the engineering job, will be outlined in this article.

Engineering is always a means to an end, and, to be fully effective, it must take into account all pertinent facts and draw on all the knowledge of the art that may exist at a given time. Telephone engineering organizations, therefore, maintain continuous contacts and coöperate with engineering organizations of other companies, as well as with other departments of their own Companies.

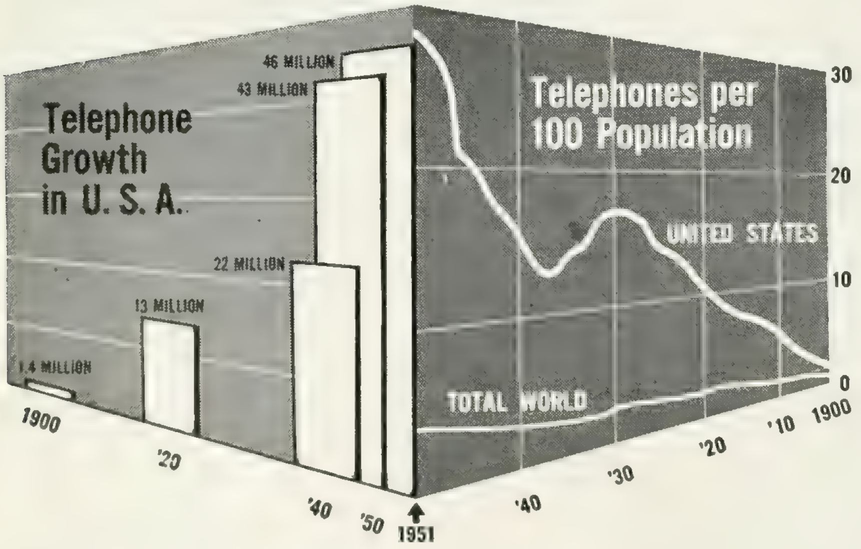
For the last five years, gross construction of telephone plant of the Bell Companies has run well over a billion dollars annually—and over a billion and a half dollars in the high year of 1948.

This work was done in every state in the Union and the District of Columbia, and covered the widest possible variety of conditions and types of plant. It ranged from a simple rural line to serve a farmer to transcontinental microwave radio relay systems to provide hundreds of toll telephone circuits or channels for television service; and from a simple switching system that might be associated with a telephone in a business office to a complicated toll switching installation which can establish telephone connections from coast to coast in a matter of seconds by operator or customer dialing and with automatic message accounting.

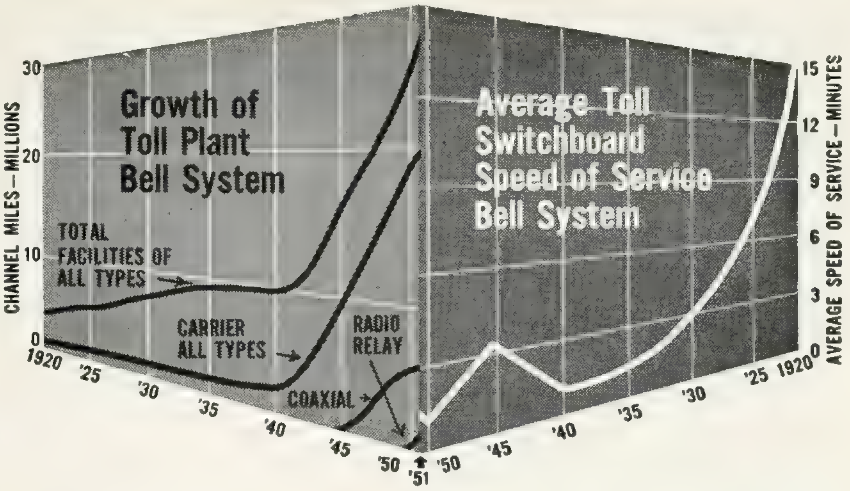
The engineering work related to such plant additions is an important segment of the activities of Engineering Departments of Bell System Companies, and involves both long range planning and the design of specific projects.

Another very important part of engineering work relates to coöperation in studies and preparation of practices covering methods for operation and maintenance of this vast and complicated plant. It is obvious that telephone plant, no matter how ingeniously designed or how well constructed, must be maintained in good working condition and operate efficiently for many years if it is to furnish good over-all service and result in successful Company operations. Other activities, such as appraisals and depreciation studies, are also an important part of the engineer's job.

This engineering work must be directed and performed for the most part by people with engineering training and experience. At the end of 1951, some 12,000 of these people were employed on this work in various Departments of the Operating Companies, and their salaries and other costs added up to over 100 million dollars in that year. They work with and keep informed of the work of engineers in other organizations: the Operation and Engineering Depart-



The great increase in the total number of telephones in the United States has gone hand in hand with the increase in the number of telephones per 100 population, bringing more service to more people ment of the American Telephone and Telegraph Company, for instance; the Bell Telephone Laboratories, where development and research work is done; the Engineering Department of the Western Electric Company, where manufacturing standards are established and equipment specifications are prepared; and engineers of many companies whose primary interest is not in the telephone business. Among these last are railroad companies, power companies, gas and water companies, municipal, state and federal engineering organizations, and others. The engineering problems encountered are, obviously, extensive and varied.



The vast expansion in toll plant has been accompanied by a notable increase in the speed of service and improvement in transmission

Basic Planning

LONG-RANGE STUDIES and basic planning precede the engineering of specific projects.

In small scale operations or small organizations, it frequently happens that specific engineering work is carried out without a formal master plan; but where successful over-all results are obtained, it usually follows from the fact that such a plan does, in reality, exist. That is, some one directing the project has worked out, if only in his mind, the broad outlines of the many factors involved to the point where there is reasonable assurance that the end result will be what is intended. An example might be the building of a small house for investment purposes. The owner might build the house himself and with no blueprints or specifications or even a street plan of the neighborhood. Nevertheless, such an undertaking, to be successful in the long run, takes a lot of planning.

In dealing with larger undertakings, such as the locations of telephone central offices, routes and type of facilities to be used for toll lines, operating methods involving operator and customer dialing of toll calls, or provision for new kinds of service, it is necessary to have over-all plans carefully worked through in advance. They will take into account many factors that may be involved in addition to the usual engineering problems having to do with the design of facilities to be constructed in the immediate future.

In making these studies, the engineers must constantly have in mind the possibilities of future technical developments and their possible application to the problems at hand, and also requirements which may be expected to develop in Traffic, Maintenance, Commercial, Accounting and other aspects of the business. These studies may even indicate the

The community dial office at Deer Park, N. Y., is of appropriate design for a small community

need for the development of new apparatus or methods.

Engineering Plant Additions

THE SIZE of the construction program in any one year depends upon the demand for new service and other factors. Plant expansions since the end of World War II have been at a relatively high rate. Most projects are designed to furnish new service within a relatively short time—say a year or two—following the completion of specific plans. This period varies, of course, for the job can be a relatively small one, such as the installation of a few thousand feet of cable in an existing conduit system. Or it may just as well be a large project involving real estate purchase, erection of a building, installation of central office equipment in the building, and the construction of cable or other outside plant to provide connecting lines to the new center.

Whatever the size of the project, it is clear that sound planning plays a very important part in the Bell System's business of furnishing good telephone and other communication service.

ESTIMATES OF FUTURE GROWTH

In any business that is not expanding, additions to the physical plant are ordinarily of relatively small magnitude. It is good practice, of course, to modernize plants even in the absence of growth, where this will result in better service or improved earnings. Activity of this kind is going on all the time in the telephone business. But, by and large, the major reason for huge plant additions over the years has been to take care of new business: that is, to serve more people or to handle more toll calls between communities. The charts on pages 178 and 179 illustrate the growth that has taken place.

In a business which is undergoing expansion, and where large annual capital expenditures are required for long periods, the problem of estimating future plant requirements and keeping the plans sufficiently flexible to permit constant and close control of expenditures is clearly one of great importance. Plant of the right type must be provided as needed, in the right quantities, and in the right places. Commercial Department people study business development, and engineers plan expansion programs after interpreting and translating estimates of business growth into plans for units of plant: that is, telephones, toll facilities, and associated items.

It is difficult enough to predict future requirements with certainty even on a short-term basis. The difficulties increase with longer-term views—such as 5, 10, or 20 years—as required for planning some kinds of plant. Even with the best of forecasting, it is essential to provide for some degree of flexibility in the design of resulting plant arrangements.

Checks must be made from time to time, as decisions are made on successive steps of a project, to see if subsequent developments warrant changes in assumptions that may result in changes of forecasts and plans. In long range estimates of business volumes, it must be assumed that exact dates when any given volume will be reached may not be strictly as estimated.

It is wishful thinking to hope for a precise method of forecasting the future. But ordinarily, plans can be made sufficiently flexible and the situation watched sufficiently closely so that, with the exercise of good judgment, expenditures for new plant can be made with good assurance that, in the over-all, the business will be kept on a sound basis.

BUILDINGS

The principal use of buildings by the Operating Companies is to house central office equipment—although much space is also required for ad-

This newly completed building at Houston, Tex., is an example of modern and efficient design for housing the latest type of toll switching equipment ministrative offices, garages, storerooms and other purposes. The general plan is to own buildings designed for permanent use; and building construction costing over 60 million dollars was done in 1951. Larger buildings are of fire-resistant design, and special efforts are made to obtain economical structures of pleasing appearance.

The locations of equipment buildings in the areas to be served are determined in a general way by long-range studies; but as the time approaches to erect a specific structure, a review is made to decide the precise location most suitable and the precise time when the building should be ready to take the equipment. Once established, a center of this kind should function efficiently for many years, as it is not economical or practicable to do any large scale relocating of equipment or re-centering of outside plant.

The most economical wire center, as established by cost studies, generally determines the site of a building to house local switching equipment, but certain other considerations need to be taken into account. Some of these are: availability and cost of land, character of underlying ground, accessibility for employees, favorable employment and transportation conditions, zoning, deed restrictions, dirt, noise, flood and fire hazards, and general suitability of the building with respect to the neighborhood.

The proper size of the building, both for the original structure and when additions are made to it for its ultimate use, is an important consideration involving considerable study of the requirements, type of equipment, and space layouts. While the future period for which it is economical to provide the space needed for growth of central office equipment and other purposes varies, current experience indicates that costs are about in balance with a period of about four years, where additions can be made at a reasonable cost. Building space too far ahead of current needs ties up capital which could be used for other purposes, so that even where costs are about in balance, careful consideration is needed in reaching a decision on size of a structure.

CENTRAL OFFICE EQUIPMENT

Many types of central office equipment are used in handling the country's local exchange and toll business.

Installations of local switching equipment may vary from a small manual switchboard of two or three positions to a large central office containing automatic switching equipment capable of handling more than 75,000 telephones, with all of the necessary trunking and auxiliary arrangements.

Installations of toll equipment may range from a few amplifiers placed at intervals along a toll route to a large center with a great deal of equipment. This may include several thousand carrier terminals, microwave radio equipment, mobile radio equipment, telegraph or teletypewriter repeater equipment, complicated switching equipment for both toll telephone and teletypewriter service, and large power plants to supply the electrical energy to keep the equipment operating.

The investment in central-office equipment in the Operating Companies has been increasing as a percentage of the total, and is now about 32 percent as compared with 17 percent thirty years ago. This trend is due in part to the continued mechanization of the local exchange plant. About 80 per cent of all telephones in the Bell System are now dial operated. Other factors are the increased proportion of small gauge exchange cable conductors because of improved telephone instruments, the use of coaxial and carrier types of toll cable instead of voice frequency cable or open wire, the introduction of microwave radio relay systems and the very extensive application of toll carrier methods. The chart on page 179 shows the increasing use of carrier.

It is clear, therefore, that the place of central-office equipment in the communications plant is a large one, and that it calls for continued attention to design and utilization in the period ahead.

Some of the engineering problems involved in planning a dial central office have been selected to illustrate procedures which, with appropriate variations, are usually present in most construction projects.

As the engineering of the equipment proceeds, decisions are made on the quantities and various types to be installed. General planning is undertaken and floor-plan layouts in detail are made showing how the building space is to be utilized in the installation of initial and future equipment.

One phase of this planning job involves the study of the central office equipment. For example:

(a) what is the best way and the correct time to make additions to an office;

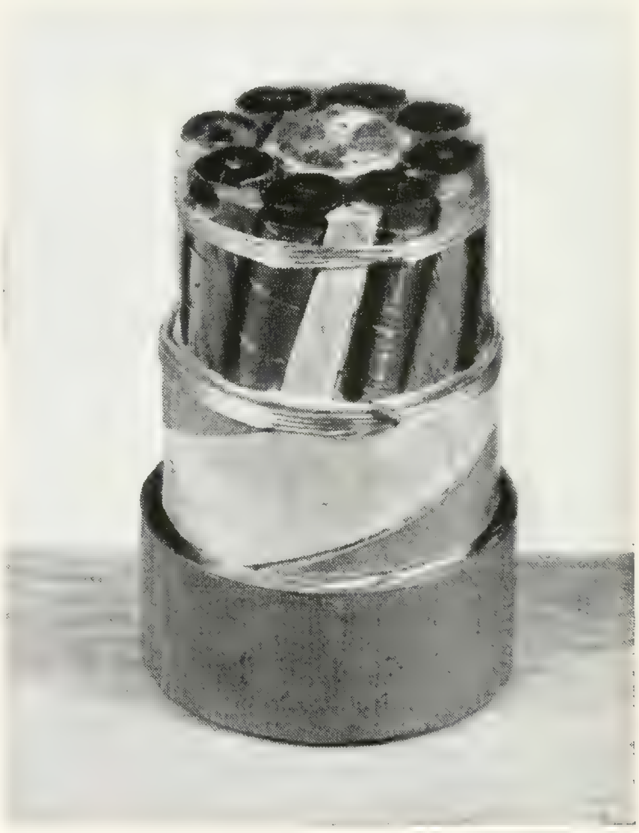
(b) can economies be made by deferring or advancing the installation of some item of equipment;

(c) should arrangements be provided initially for some feature required at a later date in order to facilitate its introduction;

(d) what is the best way to re-use equipment which may become spare at some given location;

(e) what will be the effect of future rate and class of service changes on the central office equipment and building requirements.

The planning phase of the equipment engineer's job is of greatest importance, as a carefully planned office can result in considerable economies in equipment costs, as well as give a layout which is convenient and easy to use and maintain.



Four pairs of tubes are included in this coaxial cable, each pair capable of producing 1800 telephone circuits or of transmitting television. One pair of tubes is usually reserved as "spare"

Six channels are now in operation on the transcontinental radio relay route, transmitting television and several hundred telephone conversations. This tower is at Cedar Mountain, Utah

After the general plans for a given installation are formulated, consultations with the Traffic, Plant, Accounting, Commercial and other groups are necessary to enable the equipment engineer to compile complete equipment requirements. Essential data include trunking layouts; descriptions of service and operating arrangements; methods of handling information; and requirements for service observing, rate and route, intercept, and auxiliary facilities.

Plant Department people furnish information about outside cable terminations, both subscriber and toll, for purposes of determining type and size of distributing frames. They and the maintenance engineers submit requirements for maintenance facilities, including information on local and toll test equipment.

Transmission engineers furnish data on signaling and transmission requirements for connecting the central office equipment with other offices and also with subscribers who may be outside the normal talking or signaling range of the equipment. Central-office connections must be provided when necessary for mobile radio, teletypewriter, program and video circuits, toll terminal equipment, and any testing facilities required for circuits involving these items.

All of these requirements are consolidated by the equipment engineer into specifications and drawings. These include a general description of the operating arrangement of the office and service to be provided. A series of general installation requirements are included which cover references to cross-connections, accounting procedures, job drawings for office files, and instructions for protection of building and equipment during installation.

Other sections list major items of equipment of the types needed, with initial and ultimate amounts specified; auxiliary equipment, such as for the measuring of the traffic through the main switching apparatus; tables covering trunk assignments and locations; circuits for office intercommunication; spare equipment for maintenance; test and repair service equipment; distributing frame arrangement; lighting and ventilating; and alarm apparatus and power supply.

The equipment engineer must coordinate plans for a project with installation of the correct equipment in other offices—which frequently are in the territory of another company. Plans must also provide for the removing and disposition of any equipment no longer required.

In a typical project of reasonable size which includes central-office equipment or other types of plant, estimates of the cost are prepared, as well as a case for its need and evidence of its soundness, for purposes of review and approval by other Departments. When this approval has been obtained, the project is submitted to the Board of Directors for final approval and appropriation of funds. Orders are then placed with the supplier. During the engineering and installation period, the equipment engineer is the contact between the supplier and the Telephone Company, and answers such questions as arise. Checks are made to see that the equipment and arrangements to be provided are in accordance with the Telephone Company's order.

SCHEDULING AND CHECKING

A detailed central office equipment schedule is prepared which shows: when traffic data are due; the Western Electric Company material shipping dates; the installation start and completion dates; the cutover date and similar dates for coördinated jobs, sometimes of other Associated or Connecting Companies.

Such scheduling must be closely coordinated with all departments, since directories, cable, stations, P.B.X. connections, and training are involved. The scheduling of the release of working equipment for modifications or additions requires coördination, as sometimes this work must be scheduled at night or over weekends.

It is also part of the engineering job to assist in assuring that, before equipment is placed in service, it operates satisfactorily and can be maintained economically. This requires quality-control verification of equipment by testing of individual pieces of apparatus and equipment and by over-all testing of originating, intermediate, and terminating connections.

A further engineering responsibility is to collaborate with the operating departments in analysis of general performance of equipment systems and prompt application of measures to improve performance levels and costs.

Outside Plant

The physical connecting lines between telephones and central offices and between central offices in the same city or in different cities consist principally of cable of various kinds, although open wire is still used extensively. Open wire is employed for some exchange lines and for many toll lines—particularly in those sections of the country where the requirements are relatively small and where there is reasonable freedom from wind and ice. There is a definite trend in the direction of using cable for toll lines in those areas where growth has been rapid or weather conditions are severe. Here cable is being used to take care of growth, and frequently this provides an opportunity to remove the open wire—with resulting service improvements and operating economies.

Where open wire is used for exchange service, it is still customary to use one pair of wires for each line. Consideration is being given, however, to the application of carrier, and some installations have been made on power wires. For toll lines, phantom circuits and carrier systems make it possible to get more than one circuit per pair of wires.

EXCHANGE

With the tremendous growth in residential construction during the post-war years, the outside plant engineers of the Bell System have frequently been confronted with the necessity of providing telephone facilities to large groups of houses, often in areas remote from the business centers of towns.

When a development of this sort occurs, commercial engineers survey the areas to determine the number of telephone lines required initially and what it is estimated will be needed over periods of from one to five years. The outside plant engineers then determine what plant additions should be made in order to provide the facilities at minimum cost consistent with rendering dependable service.

Examining such a situation, an outside plant engineer may find that additional lines are required between the central office and the location of the residential development. This will mean the installation, usually in conduit, of a relatively large cable from the central office, extending through the business section of town. At the end of the existing conduit, he may find that the pole line on which extensions of the existing cable are supported is carrying a maximum load, so that if the new cable extension were to be added to the pole line, the latter would be overloaded. This will usually dictate an extension of the conduit, and since it is economical to place conduit to last for a substantial period of time, the plant engineer must determine the number of ducts to be installed.

In making this decision he is, of course, guided by the commercial forecast of future demand in all of the area to be served by the conduit route, and by the results of comparative cost studies of various alternative plans. Beyond the point to which conduit is extended, the cable will usually be of smaller size than that originating at the central office and will be carried on pole lines. Studies are then necessary to determine the adequacy of the poles from the standpoint of structural design and to insure coördination of the telephone structure with paralleling or crossing power lines.

In most large real estate developments, it is economical to build a telephone distribution plant of cable rather than open wire. In such case, a type of construction frequently used consists of poles along the rear property line, carrying a cable with distribution terminals on successive poles. Drop wires are extended from the distribution terminals to the individual residences.

There are, of course, alternative forms of construction—such as buried cable in lieu of overhead cable on pole lines. Buried cable is sometimes more economical than overhead cable, particularly where curves or angles in the route of the pole line would require an excessive number of guys and anchors. In addition, buried cable offers advantages from the service standpoint, since it is not affected by storms nor subject to accidental contacts with power lines. Cables with lead sheath or alpeth sheath (polyethylene and aluminum) are available, and either may be used—depending on the conditions.

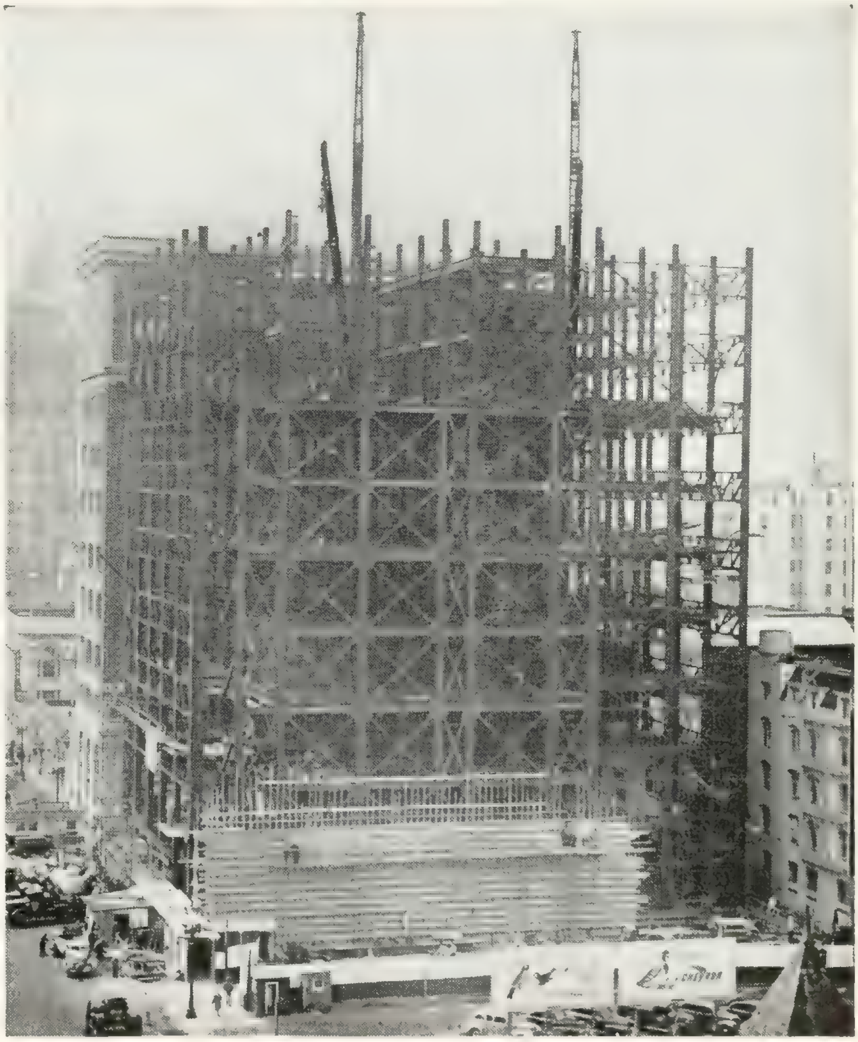
Where aerial cable is involved, it is, of course, necessary to determine and specify the size of supporting strand for the various span lengths and under the wind and ice loading likely to be encountered.

TOLL

The engineering problems involved in the construction of a toll aerial line or a toll underground or aerial cable start with studies of current requirements and determination of the general route to be followed.

Next come a detailed survey of the territory and consideration of various alternative arrangements that might be used. For example, the most direct route might be over the top of a rocky, tree-covered mountain or, as an alternative, it might be possible to place the line in a valley around the base. Cost estimates are made, and, after the most economical route and type of construction have been determined, the question of the purchase of right-of-way has to be taken up. In many cases, private right-of-way is used instead of placing the line along highways, and this involves negotiations with the property owners for long-term grants carrying provisions for maintenance and future additions to the plant.

Then comes the problem of detailed design of the aerial structure



The steel framework of this Oakland, Cal., building, being constructed to house toll switching equipment, is designed with special bracing to withstand extraordinary stresses

Not all engineering is carried on at desk and drawing board

or underground work. Where cables are used, much testing has to be done during the splicing operations. On completion of the construction work, over-all tests and inspections are generally made.

Many toll cables are designed to be charged with nitrogen gas under pressure of about nine pounds per square inch, to give an alarm and to prevent moisture from entering and interrupting service in the case of a break in the sheath. The importance of this is emphasized by the fact that some single cables may carry more than 2,000 toll circuits.

In the case of open wire lines or aerial cables, it is the general practice in many sections of the country to use creosoted pine poles—although poles obtained from other types of timber are available and are used extensively, particularly in the Mountain and Pacific States.

The engineers have the problem of determining what type of pole best suits the purpose, and it is their responsibility to follow the performance of all types, so that changes may be made if indicated by experience. Determination of sizes and spacing of poles for the various kinds of lines that must be built involves both engineering computations and the application of good judgment. New open-wire toll lines designed for carrier operation generally employ copper wires spaced 8 inches apart and with 4 pairs on a cross-arm.

TRANSMISSION

Transmission engineering has as its objective a continuing improvement, at minimum cost, in the clarity and ease of conversation to keep pace with advances in other aspects of service, such as speed and accuracy of connections.

Many types of long-life telephone sets and line facilities have been introduced into the plant over the years; and at almost every stage of development, new and improved systems are undergoing trial for early integration in the System network. Transmission engineering sees to it that these various systems are used to the full advantage of their transmission capabilities and useful life, so as to minimize replacement by more modern systems because of obsolescence.

As an example of this type of activity, consider the 500-type telephone recently introduced. This new telephone makes it possible, with economy, to provide substantial improvement in transmission for customers remote from the central office. It also provides some advantages for telephones located close to central offices —although the latter now obtain a very good grade of service with telephone sets of earlier design.

At the time of the introduction of the new telephone, in 1950, there were some 35,000,000 telephones in good condition in the plant. Because of this tremendous number in use, along with a similar quantity of lines between them and the central offices, a small change in the cost of each unit can become a major item. Hence careful study throughout the country was necessary to produce intelligent plans for the use of the new telephone. Transmission improvement would have to be provided where most needed, and yet copper economies obtained consistent with the grade of transmission desired. At the same time, it was essential to make most effective use of existing telephones of earlier types.

Another example of transmission engineering is the work involved in the design of toll circuits used with nationwide toll dialing. This new system employs a switching plan in which it is possible under some circumstances to have as many as eight links in the connection between the terminating toll offices. Furthermore, any particular call, depending on the routing, may have only one link or up to the maximum of eight. This imposes exacting requirements on the transmission design of the individual links.

The toll plant on which this switching system must operate is made up of a great number of different types of facilities of widely varying transmission characteristics.

Bell System Toll Plant

There are in service some 100,000 intertoll trunks over 25 miles in length, and many thousand shorter ones. These facilities include voice frequency circuits equipped with repeaters as required, on both open-wire lines and cables. There are several types of carrier systems used on open wire which provide from 1 to 15 or more telephone channels in addition to the voice frequency circuit. Carrier systems at present used on cables provide up to 12 channels on two pairs of cable conductors, either in the same cable or divided between two separate cables, depending on the type. Coaxial cable systems currently provide up to 600 channels per pair of coaxials, while new systems under trial are expected to produce about 1800 channels per pair of coaxials. Point-to-point microwave radio systems used for toll service, by suitable channel deriving equipment may provide up to 600 channels per pair of radio chanels, with the possibility of operating six or more such radio channels through the same antennas or on the same route.

To provide adequate transmission under the new switching plan, it is important that every trunk be designed to operate as closely as possible to the theoretical minimum transmission loss of which it is capable—as limited by echo, noise, and crosstalk. The problem is complicated by the fact that any toll circuit may consist of one or several of the various types of available plant, and a multi-link connection may well contain all types of plant.

Under these conditions, the minimum loss at which a particular circuit can be operated depends not only on its length but on the number, length, and characteristics of the circuits in tandem with it. To reduce the circuit layout job to practicable proportions it has been found by analysis that adequate performance can be achieved by the application of compromise methods. These are incorporated in the circuit design, and provide for automatic adjustment of circuit loss, depending in amount on whether the circuit is to connect two customers directly or is to be switched at one or both ends.

With the new switching plan, the number of links with which any particular trunk could be connected in tandem is controlled by the routing pattern. This creates a need and an opportunity for assignment of the available types of transmission systems among the various trunk groups in a way that will provide the best service in general. Thus those circuit groups which could be involved in connection with as many as seven other circuits are assigned the best grade of facility available, so that the transmission impairment introduced by them is minimized. In any case, however, the facility assigned to a particular trunk group should provide good transmission for calls to be routed over it.

In addition to the ability to carry messages, intertoll trunks must be provided with suitable signaling facilities to give supervisory information both to operators and to the dial switching equipment which is required for establishing and taking down connections, indicating when subscribers have called, answered, or disconnected.

The Telephone Companies provide many special services—such as for sound and television broadcasting, private line and exchange teletypewriter service, and private line telephone service. These and the domestic and overseas radio services all involve much engineering work in a field where developments are taking place rapidly.

EQUIPMENT ON CUSTOMERS' PREMISES

The equipment located on customers' premises, often referred to as the station and P.B.X. plant, includes a wide variety of apparatus. There are many types of telephone instruments, some for regular use, some for special purposes. These include key sets, loudspeakers, and microphones, and combinations of the two. There are many types and capacities of private branch exchanges, intercommunicating arrangements, and order-taking equipments. There are many types of audible and visual signaling equipment. There are numerous auxiliary arrangements, such as conference services and telephone answering devices. The teletypewriter services and equipments alone constitute an impressive list.

It is apparent that the selection, engineering, and operation of these services are highly technical matters, requiring training and experience which subscribers themselves rarely possess. They need the advice of specialists, which, generally speaking, only the Telephone Companies are equipped to give.

While the determination of customers' requirements is primarily the responsibility of the Commercial Department's servicing forces, engineers play an indispensable part both in a consulting capacity when technical problems need resolving and in the engineering of apparatus, such as dial P.B.X. systems, called for by the servicing people's analysis and negotiation with the customer.

Moreover, a considerable amount of engineering effort is devoted to installation and maintenance practices and to studies of station performance and service. These have resulted in improved techniques and apparatus which insure that the best possible service is obtained with the facilities available.

Standardization and Uniformity in Plant Design

STANDARDIZATION and uniformity in apparatus and plant design have always been considered matters of great importance in engineering the plant of the Operating Companies. Engineers of the Bell Laboratories, Western Electric Company, and the Operation and Engineering Department of the A. T. & T. Co., have this matter of uniformity constantly before them, and contribute in large measure to the establishment of uniform practices.

The engineers of the Operating Companies are kept advised of the results of the work of these organizations. They in their turn make such recommendations as seem appropriate to the executives of the Companies who have the responsibility of approving vast expenditures for the items making up the telephone plant. Such items might range from the kind of lettering on a dial to the column spacing of a building.

Engineers all along the line have responsibilities for fixing standards, or studying the results of their use, and recommending changes as conditions seem to justify such action. Like other engineering activities, standards are a means to an end. If they are too rigidly fixed or main-

When this picture was taken, these engineers at the Kearny Works of the Western Electric Company were planning the emergency replacement of switchboards serving more than 10,000 telephones, which had been destroyed by fire tained over too long a period, best results may not be obtained. On the other hand, they offer an opportunity to obtain important savings in engineering, manufacturing, and operating costs through the possibilities of multiple manufacture, installation, and operation.

It is not too much to say that a large share of the success of the Bell Companies in providing steadily improved service is directly related to the attention which has been given to standardization and uniformity in plant design. If the results of the past are any criterion, the opportunities ahead are no less great.

Other Engineering Activities

ENGINEERING PEOPLE, because of their familiarity with the design of plant, are given the responsibility for other activities that are a function of the operation of the business.

Appraisals of plant are made in connection with the purchase and sale of telephone properties and for rate purposes. Studies of factors such as service life and net salvage when plant is removed are made for use in establishing appropriate depreciation rates used in determining depreciation expense. The background provided by these studies is also of assistance in comparative cost and economy studies of different plans which are generally prepared to assist management in reaching a decision on the plan to be selected.

Another function performed by the engineers is a part in the so-called "Separations Studies" which involve the apportionment of the telephone plant and associated revenues and expenses between intrastate and interstate operations. Engineers also participate in studies relating to the apportionment of interstate revenues between participating companies.

Engineering is Management

ENGINEERING in the Telephone Companies is carried on as management staff work concerned with the preparation of studies and plans, detailed and long range, from which executive decisions are made. Examples already given bring out that at different stages in the engineering work on a project, the engineer is called upon to exercise initiative and sound business judgment as well as to apply sound technical methods. Balance is always sought between the cost of a plan and over-all results, with a better and better service the guiding star and final test. It seems clear that work of the engineers in the Bell operating organizations is an important part of management functions.

THE WORK of engineers has played an important part in the success of communications operations of the Bell Companies since the establishment of the business, and the opportunities for a continuing harvest from the fields that have been established so well seem particularly bright. With this should come good opportunities for engineers employed in communications work.

To many who have the experience that enables them to look back objectively, the opportunities they see ahead look brighter than at any time since the invention of the telephone. They are to be found in the invention and development of new things.

They are to be found in equal measure in the day-by-day job of applying modern engineering methods and principles to the building and operation of a rapidly growing communication system. New practices and procedures are continually being devised and applied—frequently to meet some urgent need.

General and continuous improvement in service furnished is the broad objective of all engineering activity in the Bell telephone organizations.

The Public Relations Story

Inquiries about the place of public relations in Bell System operations reach the Public Relations Department of the A. T. & T. Co. from time to time, from many parts of the world as well as from this country. Some are so general as to call for only an acknowledgment and the enclosure of published material. Others are specific, ask detailed questions, and require full and thoughtful answers. One of the latter kind, replying to the acting director of the Japanese Security Investment Association, in Tokyo, evoked the rewarding letter of thanks which is quoted below:

"I am quite happy to say that I could grasp the true meaning of public relations through your letter. It is neither the subject of study nor the mere way of propaganda, but the ways to work and to live as a good citizen. When I learned how your company, the Bell System, is rendering a wonderful service to your country, it led me to a conclusion that it is hardly possible to separate you from your country, for you are one living organ. The United States can not possibly exist without you and, of course, you can not exist without the United States. That is what makes you both as great as you are at present.

"There must be a lot of essential elements to build the present 'Bell System,' but I am sure that the good service by your well trained employees who know the ways of working and living as good citizens can be said the greatest.

"I would like you to know what a big effect and impression your letter has given me. I intend to introduce it to the Japanese people through our monthly magazine, 'Public Relations,' in the near future. I am going to do this, because I believe it is worthy enough as a living text-book of public relations.

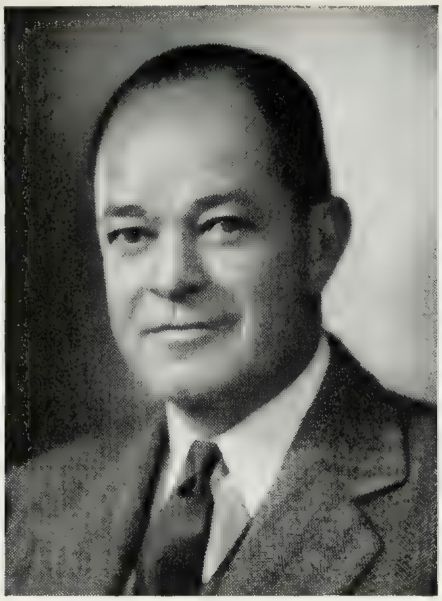
"It might be a natural thing for you to write a letter in that manner as a good citizen or as a good neighbor. But that natural act gave me so deep impression that I could not keep it to myself, but led me to tell of you and the Bell System, not only to my friends and neighbors, but also to my whole nation. A little thing really causes a great effect just like the effect of a tiny stone thrown into a pond which will spread out all over the pond.

"I thank you again for your letter and precious materials on public relations. I assure you they were greatly appreciated.

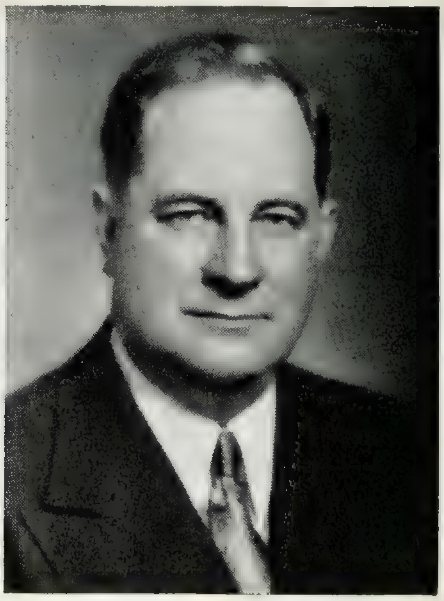
"Sincerely yours,

"Seizo Iida"

Mark R. Sullivan



Keith S. McHugh



James J. Pilliod

(*Continued from page 119*)

and by 1928 he had become General Traffic Manager for the Northern California and Nevada Area. Four years later he was made Vice President and General Manager of the Area; in 1938 his duties were made Company-wide as Chief of Staff of the Operating Vice President's organization; and in 1939 he was made Operating Vice President of the Company. In 1941 he journeyed East to become A. T. and T. Vice President in charge of the Department of Operation and Engineering. He returned to the West Coast upon his election as President of The Pacific Telephone and Telegraph Company on January 1, 1947.

A review of the Bell System career of Keith S. McHugh, President of the New York Telephone Company, was published in the Spring 1952 issue of this Magazine, which carried his "Long-Range Business Policies: A Case Study."

The January 1923 issue (Vol. II, No. 1) of the Bell Telephone Quarterly, predecessor of this Magazine, carried "Engineering the Long Lines," by James J. Pilliod, who was then head of the Long Lines Engineering Department. His conclusion was that "engineering plans for the Long Lines must be made on a broad and permanent basis, for experience has indicated that what is a line with but one or two circuits through a territory today, soon becomes a route carrying many circuits and forming an important link in the national network of toll lines." Now, almost exactly 30 years later, his contribution to this issue applies those tenets to the broader field he observes as Assistant Chief Engineer of the A. T. and T. Co. Joining Long Lines in 1908, he spent the next 35 years there in Plant and Engineering capacities and—1941–43—as General Manager of the Department. For the past decade he has been A. T. and T. Assistant Chief Engineer. He was on loan to the U. S. Army for a six-month period during World War II, and he has been active for many years in engineering and educational affairs. A telephone career of 44 years comes to a close when Mr. Pilliod retires on October 31. A testimonial which his associates presented to him last February is reproduced on page 196.

Twenty-five Years Ago in the

BELL TELEPHONE QUARTERLY

Items from Volume VI, Number 4, October 1927

The First Employee of the Bell System is Honored

A tribute was paid to the Bell System's first employee on the evening of August 17, when President Walter S. Gifford of the American Telephone and Telegraph Company was host at an informal dinner in honor of Robert W. Devonshire.

Mr. Devonshire entered the employ of the Bell Telephone Company on August 10, 1877—just fifty years ago. He is still in the service, as a Vice President of the American Telephone and Telegraph Company. His has been, accordingly, the unique privilege of participating in the development of the telephone from its feeble beginnings to its present important position as an instrumentality of nation-wide, universal service. It was in recognition of this distinction and, incidentally, of the fiftieth anniversary of his employment, that the dinner was tendered to him.

Mr. Gifford presented to Mr. Devonshire, as a souvenir of the occasion, a watch bearing the incription:

A Testimonial
to
ROBERT W. DEVONSHIRE
the First Employee of the
Bell System, August 10,
1877
Presented by President Walter S. Gifford
Salem, Mass., August 17,
1927

Formal addresses were omitted. In presenting the gift to the guest of honor, Mr. Gifford briefly pointed out the significance of Mr. Devonshire's long period of service and of the fact that the Bell System's first employee is still actively engaged in telephone work. Several of the other guests spoke informally of the earlier days of telephone history.

Telephone Service Inaugurated Between the United States and Mexico

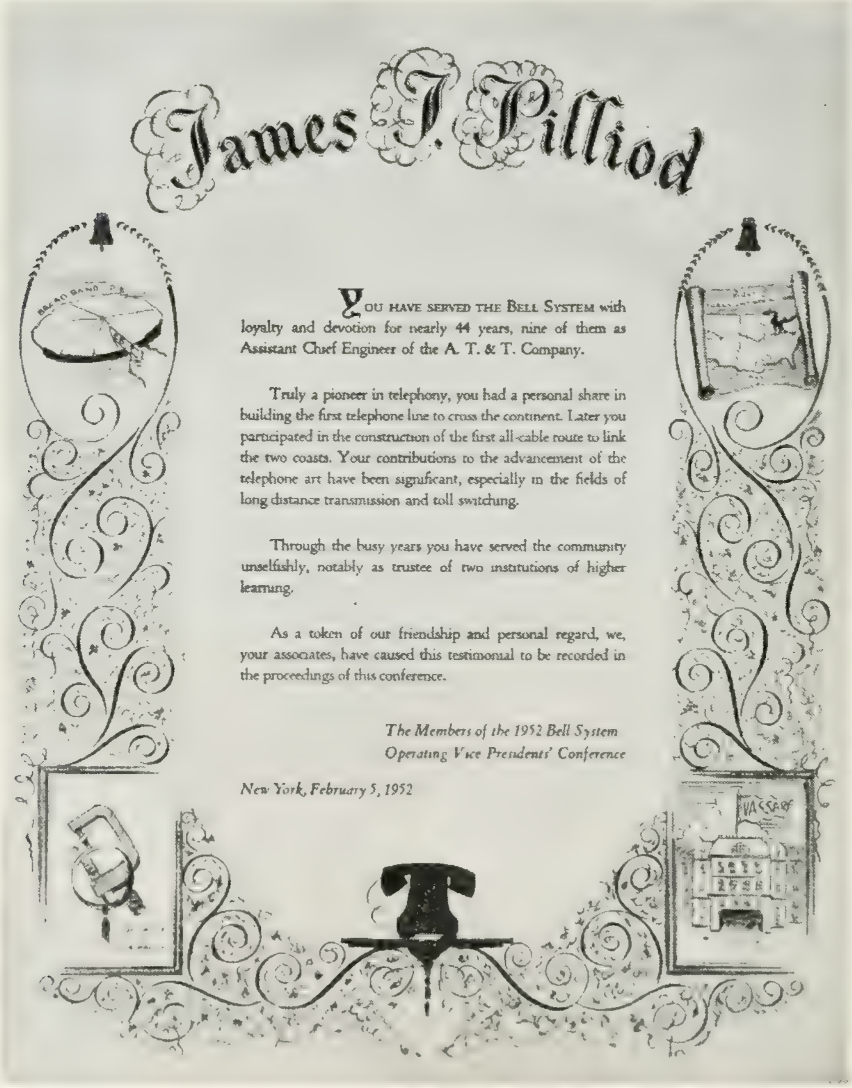
An exchange of greetings between the Chief Executives of the United States and Mexico marked the ceremonies inaugurating long distance telephone service between the two republics on September 29. Notable gatherings of government officials, members of the diplomatic corps and other guests were present at the exercises in the Pan American building in Washington, D. C. and in the National Palace in Mexico City which were connected for the occasion by long distance telephone lines.

The Washington-Mexico City circuit it had been planned to use for the inauguration ceremony ran from the capitol city to New York, thence through Chicago, St. Louis and Dallas to Laredo, Tex., over the lines of the American Telephone and Telegraph Company, a distance of 2,571 miles. From Laredo the route was over the lines of the Mexican Telephone and Telegraph Company (a subsidiary company of the International Telephone and Telegraph Corporation) through Nuevo Laredo, Saltillo and San Luis Potosi to Mexico City, a distance of 786 miles. The total length of the circuit was thus 3,357 miles.

The most careful preparations had been made, an emergency circuit tested, and at one o'clock on the afternoon of the twenty-ninth, everything was in readiness for the event. But Nature stepped in with a tornado that swept St. Louis and its surrounding sections and knocked the most painstaking plans askew.

Regular and emergency circuits went out of service together—providing the material for one of tensest dramas in the history of the telephone. In three and a half hours, the Presidents of two republics were to talk to each other by long distance—and four minutes of high wind had wiped out the circuits which it had taken a week to prepare for the ceremony.

Within fifteen minutes after the lines went dead, other routes were being selected. Chicago had been asked to get through to Muskogee, via Kansas City, to connect with the original circuit south of St. Louis. New York started work at once on setting up a route which doubled back through Washington to Atlanta and New Orleans to Shreveport, where it picked up the original emergency circuit. At four o'clock communication was established with Mexico City over the latter circuit.



James J. Pilliod

YOU HAVE SERVED THE BELL SYSTEM with loyalty and devotion for nearly 44 years, nine of them as Assistant Chief Engineer of the A. T. & T. Company.

Truly a pioneer in telephony, you had a personal share in building the first telephone line to cross the continent. Later you participated in the construction of the first all-cable route to link the two coasts. Your contributions to the advancement of the telephone art have been significant, especially in the fields of long distance transmission and toll switching.

Through the busy years you have served the community unselfishly, notably as trustee of two institutions of higher learning.

As a token of our friendship and personal regard, we, your associates, have caused this testimonial to be recorded in the proceedings of this conference.

The Members of the 1952 Bell System
Operating Vice Presidents' Conference

New York, February 5, 1952

Testimonial presented to Mr. Pilliod by his colleagues prior to his retirement in the Autumn of 1952

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B+T

Bell Telephone MAGAZINE

FEB 11 195

A Statement by the Directors of the American Telephone and Telegraph Company

Finding Troubles Before They Happen • G. Robert Knell

Extending Uncle Sam's Voiceways in Alaska
Otto W. Kammerer

Design for a Good Rate Structure • Helene C. Bateman

Operating in the Hazards of Deep Snow • Stuart Shaw

rican Telephone & Telegraph Company · New York

Bell Telephone *Magazine*

Winter 1952-53

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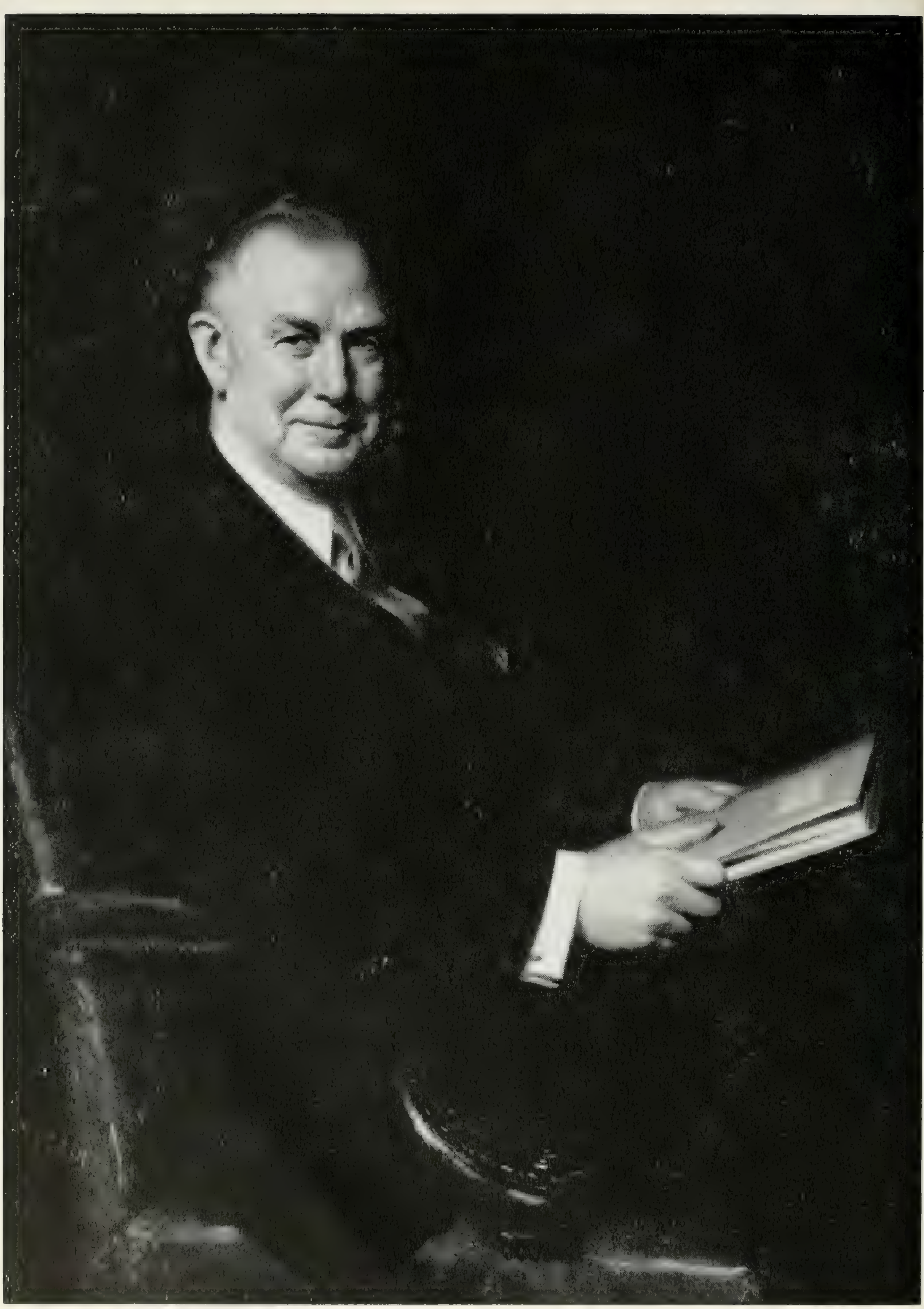
A Medium of Suggestion & A Record of Progress

JUDSON S. BRADLEY, *Editor.* *Published four times a year for the supervisory forces of the Bell System by the Public Relations Department of the*
AMERICAN TELEPHONE AND TELEGRAPH CO., *195 Broadway, New York 7, N. Y.*
CLEO F. CRAIG, *President;* S. WHITNEY LANDON, *Sec.;* ALEXANDER L. STOTT, *Treas.*



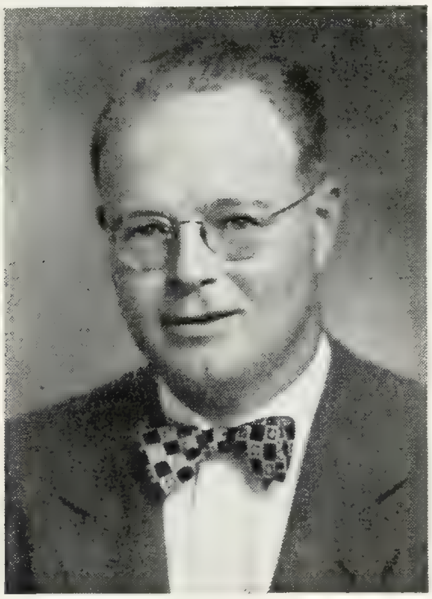
CLEO F. CRAIG

PRESIDENT, AMERICAN TELEPHONE AND TELEGRAPH COMPANY

A portrait by Paul Trebilcock

Who's Who & What's What *in This Issue*

Between 1929 and 1943, G. Robert Knell's experience in the Long Island Area of the New York Telephone Company included Commercial, Engineering, and Plant assignments which led to successive appointments as installation foreman, chief switchman, and wire chief. From 1943 to 1946 he saw service in the U. S. Navy, and in the latter year he returned to the Engineering Department of the New York Company. In 1948 he was appointed maintenance engineer for the Long Island Area; in 1950 he became district Plant superintendent for Staten Island; and the following year he was made division Plant superintendent for North Brooklyn. Early in 1952 he became a member of A. T. & T.'s Department of Operation and Engineering, where, as Plant service engineer, he works with the Plant Departments of the Associated Companies on installation and maintenance problems.



G. Robert Knell

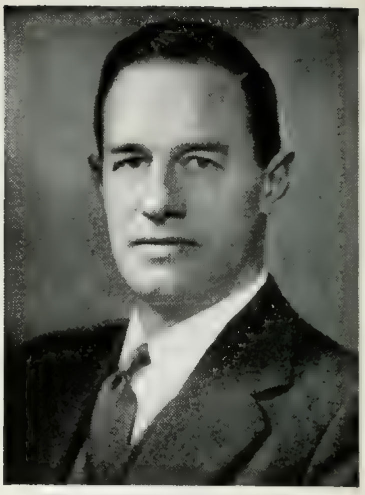
Joining the Long Lines Plant Department in Chicago in 1920, Otto W. Kammerer had had much telephone construction experience throughout the mid-West by the time this country became involved in World War II. In May of 1942 he received a military leave of absence to join the Signal Corps, with which he served in the European Theatre. He was concerned in planning wire communications in France for the Ninth Air Force, took part in the landing on Omaha Beach, and later worked on the rehabilitation of telephone cables on the Continent. Discharged in 1945 as a lieutenant colonel, he is the holder of the Legion of Merit and four bronze stars. He was assigned temporarily to the Western Electric Company in 1950 to help engineer and construct the Alaskan project about which he writes. He returned to Long Lines in 1952, and is again on temporary assignment to Western Electric.

Otto W. Kammerer

(*Continued on page 260*)

Winthrop W. Aldrich
Chairman of the Board,
The Chase National
Bank, New York

James F. Bell
Chairman, Committee
on Finance and
Technological Progress
General Mills
Minneapolis

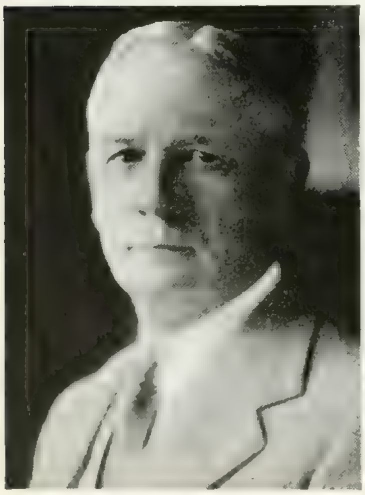


Lloyd D. Brace
President,
First National Bank
of Boston

Directors of the American Telephone and Telegraph Company

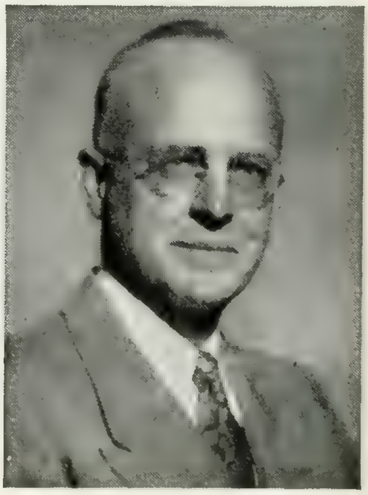
Vannevar Bush
President,
Carnegie Institution
of Washington

Cleo F. Craig
President of the
Company
New York



David A. Crawford
Director and
Formerly President,
Pullman, Inc.
Chicago

John W. Davis
Davis Polk Wardell
Sunderland and Kiendl
New York



Hal S. Dumas
Executive Vice President
of the Company
New York

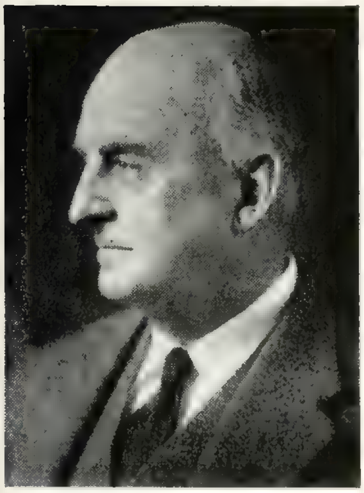
A Statement by the Directors Of the American Telephone And Telegraph Company

Under the title of "A Message from Your Board of Directors," the following statement, with pictures of the 19 men who serve in that capacity, was sent to the more than 1,200,000 share owners of the American Telephone and Telegraph Company on January 15, 1953, with the checks for the 127th consecutive quarterly dividend. EDITOR.

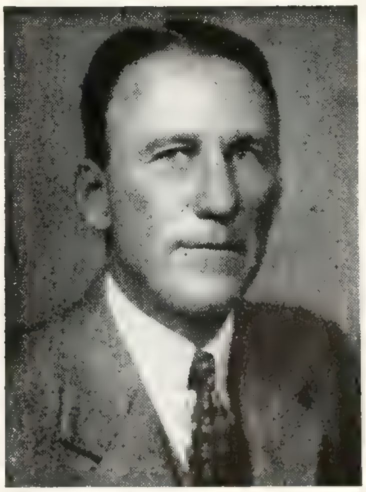
AS WE BEGIN this New Year, we should like to greet all of you who share ownership of the business, and tell you how we feel about the duties you have entrusted to us.

Each of us considers that he is a trustee for the savings of every individual who has put money in the business. It is our responsibility that the Company shall prosper.

We are sure that to perform this duty, we must serve the public as well as possible. The Company is a servant of the public. The services



W. CAMERON FORBES
Partner,
J. M. Forbes &
Company, Boston



G. PEABODY GARDNER
Trustee
Boston

JOHN L. MCCAFFREY
President,
International Harvester
Company, Chicago

Arthur W. Page
Business Consultant
New York

Thomas I. Parkinson
President,
The Equitable Life
Assurance Society of the
United States, New York

Elihu Root, Jr.
Lawyer
New York

it performs are necessary to the people of the United States. They are necessary to the building of our nation and to our national security. Clearly, we occupy a position of great public trust.

We think it all-important therefore that we furnish the best telephone service it is in our power to provide—a service high in value and steadily improving—at a cost to the user that will always be as low as possible and at the same time keep the business in good financial health.

The success of the business depends on the people in it. To serve well and prosper, the Company must attract and keep capable employees. They must be well paid and have opportunity to advance in accordance with ability. And we must continually develop first-rate leaders for the future.

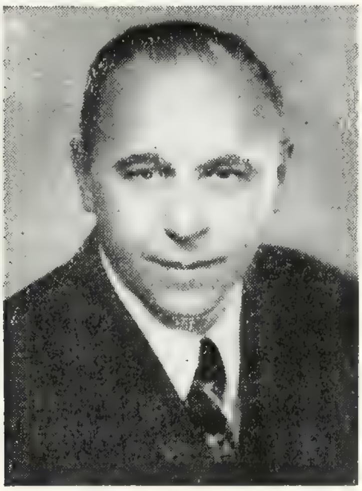
Finally, it seems to us that it is always our duty to act for the long run. Sound financing, good earnings, reasonable and regular dividends —these are all long-term projects. So is our continual research to find better means for giving better service. So is the building of the human organization and character on which good service depends. So is the training of leaders. In all our undertakings, the long view is essential.

This is the way we understand the trust you have placed in us. It is a trust that deserves, and will continue to receive, the most painstaking care we can give it.

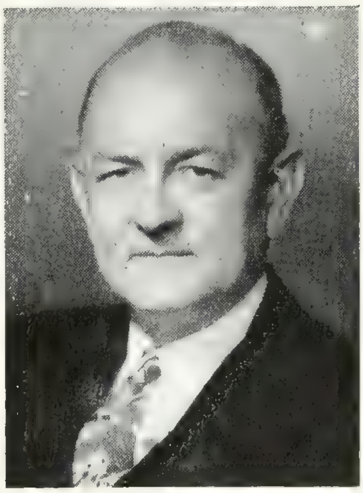
TOM K. SMITH
Chairman of the Board,
The Boatmen's National
Bank of St. Louis

MYRON C. TAYLOR
Formerly Chairman
of the Board,
United States Steel
Corporation, New York

SAMUEL A. WELLDON
Formerly Chairman
of the Board,
The First National Bank
of the City of New York



WILLIAM WHITE
President, New York
Central Railroad
Company
New York



A. LEE M. WIGGINS
Chairman of the Board,
Atlantic Coast Line
Company
Hartsville, S. C.

Preventive Maintenance Guards the Dependability of the Service While Holding the Expense of the Operation in Economic Balance

Finding Troubles Before They Happen

G. Robert Knell

MOTHER waxing the floor, Dad greasing the car, and young Jimmy visiting the dentist twice a year are all taking part in preventive maintenance programs which are considered important in our way of life. Less familiar, perhaps, is the preventive maintenance provided to insure the continued high quality of service which has become a way of life in the Bell System.

Customers usually measure the quality of their telephone service by its dependability. Twenty years ago, each of them, on the average, notified us once in every 14 months that his telephone would not work or service was unsatisfactory. Today, improvements in both equipment and preventive maintenance measures have increased that interval to once in every 24 months. Telephone folks can look with pride on that accomplishment, and it is safe to predict that in the next twenty years the interval between reports of trouble will be ever greater. However, even with the best efforts in design, construction, and maintenance, completely trouble-free service is impossible—since the elements and outside agencies often damage the plant.

Telephone maintenance work may be divided into two types, corrective and preventive.

Corrective maintenance is the actual finding and correction of trouble conditions after they have had a recognizable effect on customers' service. They are brought to our attention by customer complaints of trouble or dissatisfaction with their telephone service; by some member of the telephone family who recognized a fault or failure during his daily work; or by a variety of complex trouble alarms, indicators, or recorders.

Preventive maintenance, on the other hand, is anticipating and correcting potential trouble conditions before they can affect the service of our customers. In other words, finding troubles before they happen.

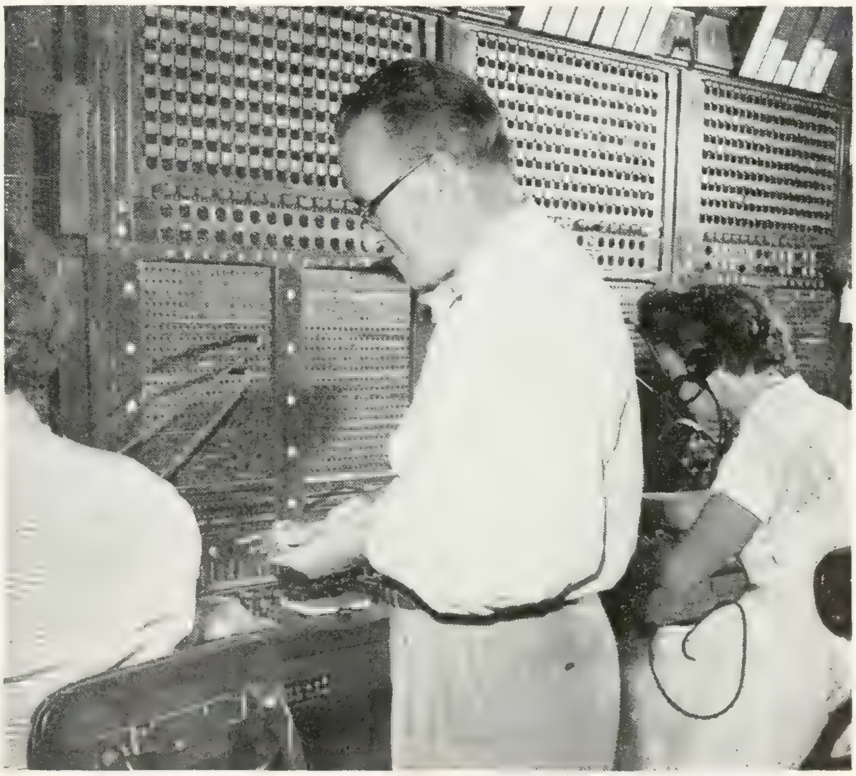
An Early Example

To explain the method by which preventive maintenance measures are developed, let's look back for a moment into the early days of the industry.

Many years ago, Plant people recognized that one of the major sources of interference with good customer service at manual switchboards was traceable to the switchboard cords. Constant handling of the cords by the operators and repeated bending when the plugs were inserted in the jacks caused the fabric covering to fray and then break. Having reached this weakened mechanical state, the wires in the cord would soon break. During the busy hours of the day, these inoperative cords could often seriously hinder the flow of telephone traffic.

Having detected the trouble and recognized its cause, a preventive maintenance measure was readily apparent. Frequent inspection of the switchboard cords, and replacement of those that had become frayed, effectively eliminated that interference with service. But the plant folks of the day, keeping a watchful eye on costs, soon found that too frequent inspections led to an uneconomical performance. Records of the number of times that operators reported failure of a cord in service, as well as the number of frayed cords found on inspection, were used to establish proper and economic intervals between inspections. Because of the recurring nature of such inspections, they became known as "routines," and the interval between inspections as the "routine frequency."

Determining today's requirements for preventive maintenance measures in a nation-wide telephone system is a sizable job. It becomes more impressive when we consider that this equipment enables any telephone user not only to be connected with the 45 million telephones in the United States but with 96 per cent of the 79,300,000 telephones in the world. Furthermore, 80 per cent of the Bell System's telephones are currently handled by a variety of complex dial cen-



One of the early forms of preventive maintenance: checking the cords for wear at a veteran manual switchboard tral office equipments, and somewhat more than 40 per cent of their toll traffic is handled by mechanized equipment which permits the originating operator to complete calls by dial methods. *Amazing* is not too strong a word!

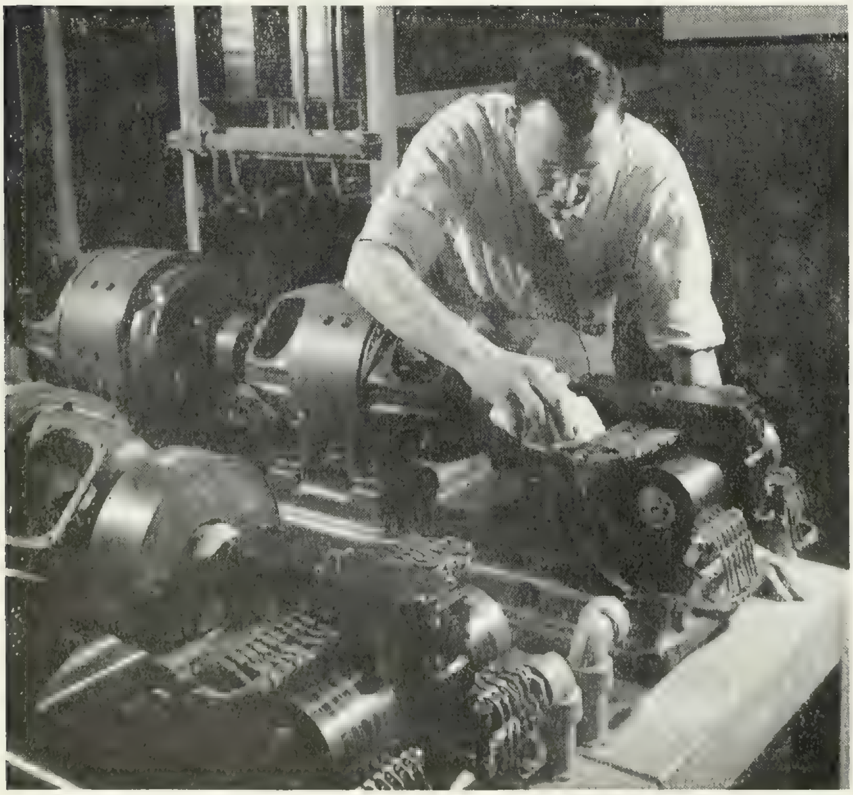
Preventive maintenance has grown in requirements and methods, progressively, as the telephone system has increased in complexity. No longer are troubles limited to the individual customer's telephone, line wire, and simple manual switchboard equipment; nor is the plant man's "look-see" sort of inspection a completely effective measure. Advances in the art of dial telephony have introduced "common" equipment, so-called because it is used by more than one line in the office. Dial senders, decoders, and markers, often referred to as the mechanical operators, fall into this category. Although used to establish a call, they automatically release upon completion of their function, to become available for other calls. Complicated test equipment, mounted on frames or "test wagons" and in portable test sets, provides means for periodic checking of the operating capabilities of such equipment, to aid in revealing any potential trouble conditions that may exist.

Built-In Preventive Maintenance

During this era which we might call "the telephone age," an ever-present desire to improve telephone service is apparent.

Let us look now at the development of preventive maintenance methods for dial central office equipment. "Step-by-step," the first type of dial equipment used in the Bell System, had no means for automatically recognizing trouble conditions before they affected customer service. Preventive maintenance effort consisted of inspection, lubrication, and manual testing of the dial equipment under limiting conditions.

When the Panel dial system was developed, in the 'twenties, complex "common control" equipments were used. Engineers, recognizing the inadequacy of manual testing methods for this complicated equipment, devised automatic test frames. They are capable of automatically



A regular preventive-maintenance task: cleaning the alternative ringing machine applying mechanical and electrical tests more severe than the operating conditions encountered in customer service. When a test frame recognizes a trouble condition during a test, it gives an alarm—and a plant man can fix the trouble before it can affect customer service.

In the 'thirties, additional preventive maintenance aids were built in to the newer No. 1 crossbar dial system. In the older systems, when the equipment encountered a central office trouble while completing a call, the customer was stranded and eventually had to "hang up." Yet when he dialed again, usually the call was satisfactorily completed. In crossbar offices, when a central office equipment failure is encountered, the equipment automatically "recycles" itself, and attempts to complete the call by using different central office equipment. In telephone parlance, we make a second attempt, and generally complete the call for the customer without making him re-dial. In addition, under many failure conditions, a trouble indicator is connected momentarily to the equipment to identify by lighted lamps the equipment associated with the failure. Plant people are then able to analyze successive failures and pinpoint equipments which require maintenance.

In the 'forties, a trouble recorder was provided in the No. 5 crossbar system to replace the trouble indicator. This equipment provides the same feature of identification of equipment involved in a failure, but it accomplishes the recording by punching out a card rather than requiring a central office man to read the lamp indications. Thus a record can be obtained of most troubles for later analysis even though a plant man may not be available at all times.

Directing Preventive Maintenance Activity

Just where to apply preventive maintenance is found pretty generally by analyzing the records of corrective maintenance. Looking at a particular case of trouble will perhaps show how it contributes to the records which will eventually reveal the need for preventive work.

Mr. John Customer, unable to use his telephone because he doesn't get "dial tone," calls the telephone repair service bureau from a neighbor's house to report Republic 9–1234 out of order. Susan Bell, the repair service clerk, takes the details of the complaint and enters them on the "daily trouble log" and on the "line card" for Republic 9–1234. The line card then goes to Peter Deskman, who makes a test of the line. From it he concludes that the trouble must be in the central office, and so he passes the necessary details along to Sam Switchman.

Sam finds that Mr. Customer's "no dial tone" was caused by a contact trouble on the line relay associated with Republic 9–1234. After making the necessary adjustment, he advises Pete that the trouble is cleared and makes an entry in the central office trouble records to indicate that a Republic 9 line relay had to be adjusted.

Pete enters on the line card the details of the trouble found, retests the line, and advises Mr. Customer that his line is "OK now."

A manual routine testing operation on dial equipment: checking selectors in a step-by-step central office

Susan then closes out the complaint by classifying the Republic 9–1234 entry on her "daily trouble log" as a trouble found in the central office equipment. And she summarizes her logs daily and monthly to indicate how many troubles have occurred in each classification of plant.

At the end of the month, Pete's and Sam's supervisors get together to review results. From the summary of "daily trouble logs" they find that central office troubles in Republic 9 are increasing, and from the central office trouble records they discover that the larger part of the trouble involves line relay contacts. They immediately plan a preventive program to inspect and adjust the line relay contacts in the Republic 9 office.

Obviously, the maintenance team of Pete Deskman, Sam Switchman, and Joe Repairman does not find the cause for every customer's complaint of trouble. Even so, careful analysis of several such "not-found" troubles may identify equally productive points for the application of preventive maintenance measures.

DETERMINING the requirements for preventive maintenance work, as well as providing the methods and determining the interval between applications, are all initial steps in the overall program. Tools and training must be provided for the 125,000 Bell System people who at various times perform maintenance tasks. Both school instruction and day-to-day job training provide basic knowledge, but they need to be supplemented by a vast amount of information.

Bell Laboratories engineers provide detail drawings and descriptions of the operation of each new piece of equipment, as well as instructions on maintenance, adjustment, cleaning and lubrication. Bell System Plant and Engineering people in both the A. T. & T. Co. and the various Operating Companies assist in the latter work and prepare practices on the administration of the job and any specialized local situations, and Western Electric Company folks manufacture the test equipment.

With the complexity of the telephone plant that we meet in our daily work, satisfactory customer service requires engineering, laboratory, and manufacturing folks to play on the same team with the repairman.

Watching the Costs

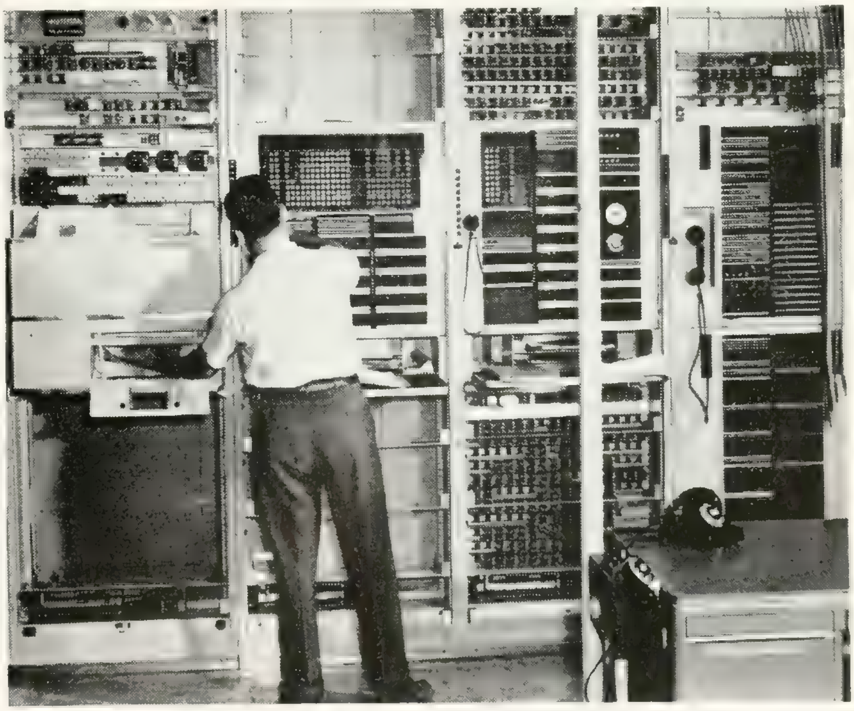
PLANT PEOPLE must keep a watchful eye on costs. Too much preventive maintenance work can force costs to a point of diminishing return which will make the entire operation uneconomical.

We might return momentarily to our original example of Dad and the family car. When it was purchased, the owner's manual recommended 300-mile and 1,000-mile inspections and servicing, followed by a continuing series of greasing, lubrication, and other miscellaneous items, all at stated intervals or mileages. Dad read the advertising at the service station, too—and bought all of the items recommended there. Undoubtedly he was pleased with the car, and it gave the family excellent trouble-free service. Dad, a cautious fellow, had followed instructions—but he sometimes grumbled when the bill came in on the first of the month.

Central office preventive maintenance routines had developed over the years until, in the late 'forties, service furnished by the equipment was good; yet looking at the maintenance bill every month raised a question as to the proper economic balance between maintenance cost and the quality of service obtained.

The situation was reviewed in 1948, and a large-scale study was started to determine what might be the proper relationship. Central office buildings of various types, in all parts of the country, were selected to participate in a long-term trial.

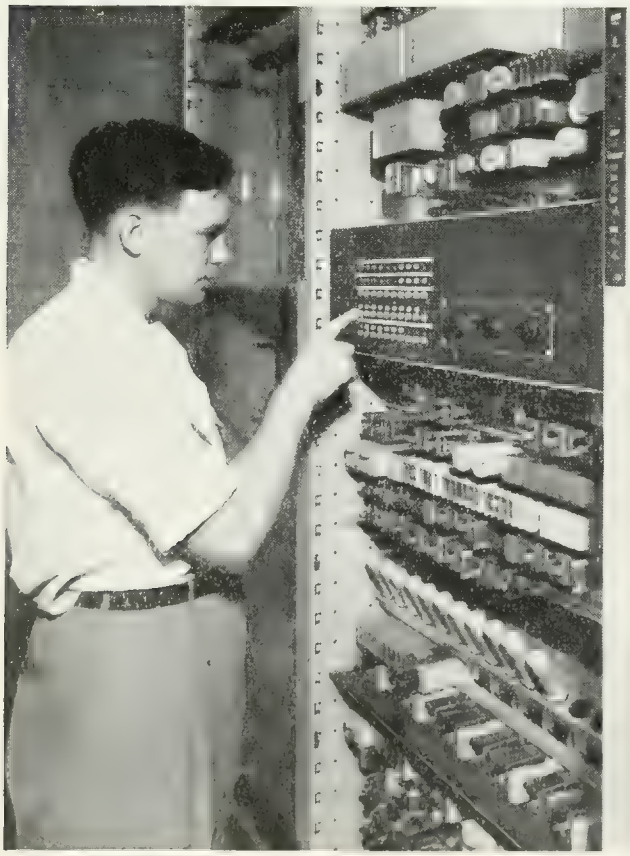
A committee composed of Engineering and Plant men was established in each of these offices to control the trial, protect the quality of customer service, and insure against any progressive deterioration of equipment. Then all preventive maintenance activity (except certain lubrication of power driven machinery) was temporarily suspended. As customers reported their troubles, tabular records were kept; and as indications of need developed, preventive routines were reëstablished. In addition, plant people kept a watchful eye on the equipment and, as needs became evident, suitable



Removing a card from the trouble recorder: a more modern way of locating trouble than by laborious hand testing routines to care for such conditions were also reëstablished.

Results of the study indicated that, although some routines had not been performed often enough, many had been performed too often to pay their way. Furthermore, there was strong evidence that even in two offices of the same type, the same routines and routine frequencies were not required. That is, the application and use of preventive maintenance routines must be tailored by the Plant folks concerned to fit the needs of their own office. Aids for determining the requirements for preventive maintenance measures in any office were devised, and Plant people are now operating their offices on a "qualitative preventive maintenance" basis.

The application of the results of this study to central office maintenance programs across the country has improved customers' service. Furthermore, the qualitative approach has provided appreciable saving of effort in day-to-day preventive maintenance work. The changes from older methods of operation were accomplished without dislocation of central office people, and it is expected that further savings will accrue as qualitative methods are applied in the maintenance of other types of telephone plant.



Pushing the button automatically performs a line insulation test

An Outside Job

Almost everyone is familiar with the sight of telephone men working on the cables, poles, and wire which are collectively called outside plant. This plant accounts for somewhat more than half of the total investment in telephone property and contributes more than a quarter of the customer troubles. Periodic inspections are an important part of the maintenance program designed to keep it in both safe and serviceable condition.

Annually, supervisors inspect the outside plant to detect trouble conditions which may develop into hazards to public safety or may affect customer service. Knowledge, thus gained, of plant conditions is used to direct the more detailed inspection and repair work of telephone people skilled in the various phases of the job. In addition, every telephone man takes pride in noticing and correcting or reporting every trouble or potential trouble condition that he sees.

On some of the long distance cable routes which are vital to country-wide communication, inspections have become standard procedure. For instance, the cables connecting Boston, New York, Baltimore and Washington have all been placed underground for maximum protection. Nevertheless, a telephone man is assigned the task of riding in an automobile along the route of the cable to make sure that builders, road workers, or other construction people will not unknowingly damage the plant. In some of the more active areas, this ride is a daily affair, and in others it may occur once a week.

This outdated manual way of performing a line insulation test is being superseded by the automatic method shown on the opposite page

In the wider spaces of the West, where our cables go across country rather than along the highways, such patrols may be made from an airplane. For example, the buried cable between Shreveport, Dallas, and El Paso is one which is regularly patrolled by air to guard against unwitting damage by farmers or by pipeline, oil well, and similar construction workers.

Line Insulation Testing

ALTHOUGH inspections are effective and economical in keeping the outside plant in good condition, they cannot be completed often enough to prevent the development of serious troubles between the cycles. The largest source of such trouble is water or moisture getting inside the sheath of the cables and affecting the insulation between wires. During dry weather, breaks in the cable sheath have little or no effect on customer service, but during a rainstorm, water entering the cable may cause hundreds of troubles. The value of a means of rapidly detecting sheath breaks during dry weather was recognized many years ago, but little progress was made until the 'forties—when a new electronic line insulation test set and related techniques for its use were developed.

The success of line insulation testing as a preventive maintenance measure is attested to by its contribution to a 25 percent reduction in the number of customer reports of trouble caused by outside plant in 1952 as compared to 1947. This success is not due solely to the development of new equipment, but should be largely credited to the fine spirit which exists on the telephone team. Line insulation testing is most effectively performed in the hours just before sunrise. At this time, air in

This patrol plane is dropping a warning message, shown at right center, to a road grader working near a buried telephone cable

the cable is usually at its lowest temperature, and has contracted and drawn additional air and its contained moisture through any break in the cable sheath. This lowers insulation resistance and permits the test set to recognize a potential trouble. The record of failures encountered by the central office man who makes the test is passed along to a tester or deskman who identifies the cable involved and analyzes all indications to discern what troubles are most likely to be found. He in turn dispatches a cable repairman to locate and repair the trouble. Since all of this work must be completed before the sun has dried the moisture out of the cable, the effectiveness of the method can only be measured in terms of teamwork displayed.

A more recent development in this field is an automatic line insulation test set capable of scanning 12,000 lines per hour and recording encountered troubles on a teletypewriter in the test bureau. The set should further improve performance, and will relieve central office people of the task of making manual tests before sunrise.

Air as a Preventive Tool

The trunk cables connecting and carrying the conversation between various central office buildings and cities are a vital link in communications. As such, they demand especially high-grade preventive maintenance treatment.

Some years ago, a very successful measure was developed. These cables are filled with dry nitrogen gas held at a pressure of 6 to 10 pounds, pumped up, in effect, just as we pump up a tire on our car. Pressure-sensitive switches are provided at various points along the cable run and, should a sheath break develop, the drop in gas pressure will close a switch to give an alarm at some central point, thus drawing the attention of maintenance people to the failure. In addition, the gradual escape of gas through a small break will prevent moisture from entering the cable to interfere with service, until repairs can be made.

Although this system is the best so far devised for maintaining cable plant in good condition, it is too costly for general use on the distribution cables serving customers. More recently, a trial "continuous flow gas pressure system" was installed on the distribution cables at Caldwell, New

Digging down *to telephone wires, to free them from their unaccustomed burden of snow, is an unusual form of preventive maintenance*

Jersey. At the central office, an air compressor and dehydrator supply dry compressed air at 6 to 9 pounds' pressure to the cables leaving the building. Before entering the cables, this air is passed through gas flow meters similar to those which measure the gas used for cooking, so that maintenance people can tell how much air is entering each cable. Although all ends of the cable have been sealed with air-tight plugs, some air is always flowing into the cables because of minute leaks, and a normal weekly consumption through the meter for each cable was established. Central office men, keeping an eye on the meters each week for excessive air flow, can readily observe when a break occurs in a cable, and can dispatch a cable repairman to fix it before service is affected. And again we have the advantage that, in most sheath breaks, escaping air will prevent moisture from entering to affect the insulation and thus protect customers' service even under bad weather conditions.

This continuous flow system of cable maintenance has been effective in aiding to provide maximum customer freedom from troubles due to sheath breaks. However, costs are still too high to make it economically attractive except under the unusual circumstances encountered in such places as the island of Nantucket, Massachusetts, where our customers are 30 miles at sea, or in Brownsville, Texas, where cable beetles drill holes in the sheath just as termites might damage a house.

Operation Snow Shovel Typifies the Future

The activities so far discussed have been in the realm of the everyday problem. Sometimes preventive measures must be developed on the spur of the moment to meet an unusual situation.

During March of 1952, snowfall of unprecedented heights developed in some areas in the Sierra Nevada Mountains, where there is a cross-country long-distance open-wire line. In fact, in some places, the snow was as much as ten feet over the top of the lines. Knowing that the snow would pack tightly as it melted, and thus place strain on both poles and wire, which would eventually demolish the line, a hardy telephone team recognized an unusual condition and organized "Operation Snow Shovel." All of the snow to a level just below the wires was shoveled out to form a trench twelve to fourteen feet wide and as much as sixteen feet deep along the parts of the line that were endangered.

With nation-wide operator toll dialing an accomplished fact in many of our cities, and with Englewood, New Jersey, customers now dialing directly such points as San Francisco, the need for maintaining equipment in trouble-free condition becomes more vital daily. There is no doubt that a team which can devise the routine measures discussed in this article, and likewise tackle an "Operation Snow Shovel" on the spur of the moment, can also continue to improve service and reduce costs to meet the needs of the business.

The Bell System Helps the Alaska Communication System In Designing, Building, and Equipping a New Element in This Country's Northern Communications Frontier

Extending Uncle Sam's Voiceways in Alaska

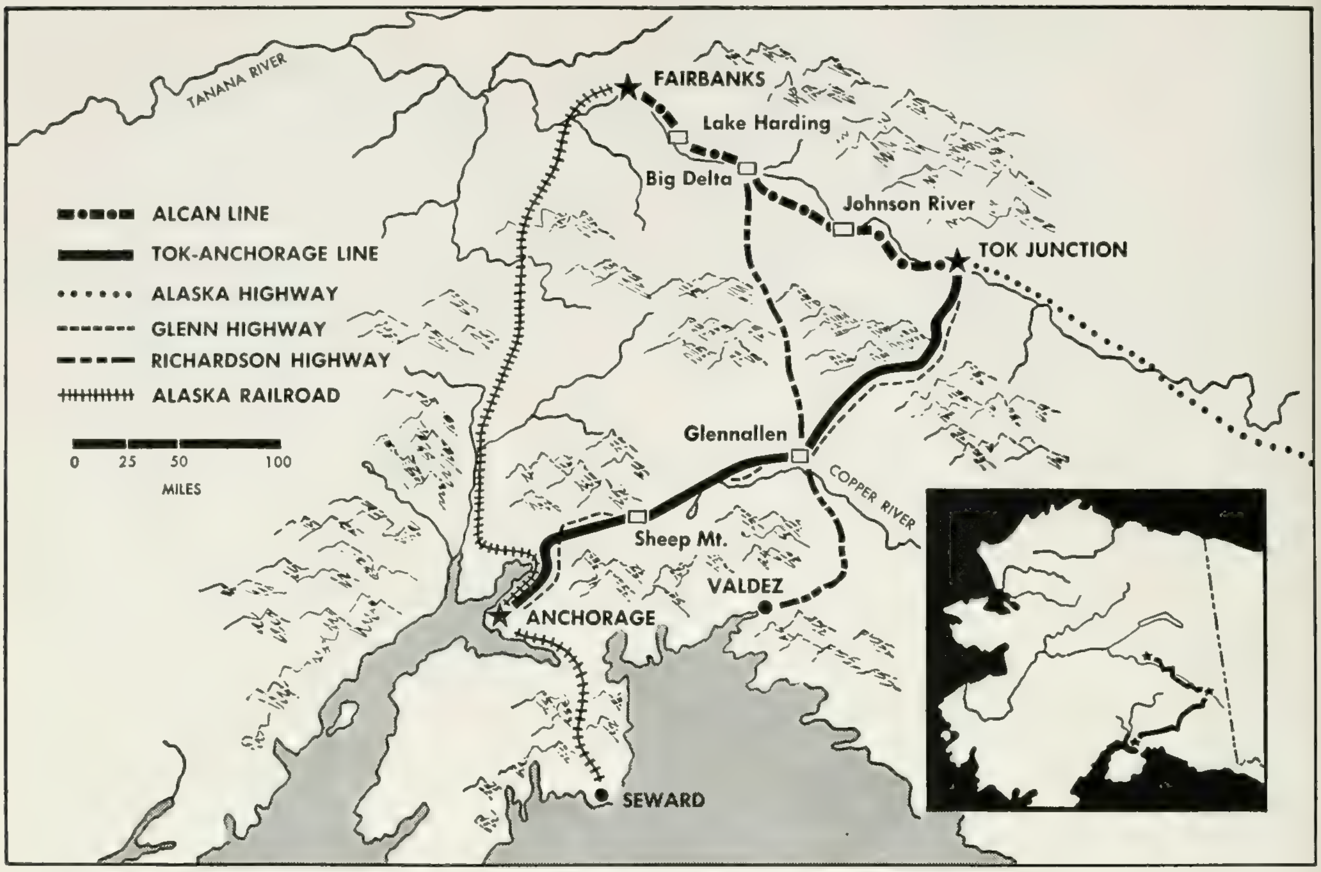
Otto W. Kammerer

After more than two years of intensive work in rugged country, the Bell System turned over to the Army last October a new telephone line which becomes an important northern link in the long distance network for national defense. The new facilities substantially increase the voice and telegraph channels available for military communications between Anchorage and Fairbanks in Alaska, and serve other Territorial government and civilian uses as well.

Under an Act of Congress passed in 1900, the Alaska Communication System of the Army Signal Corps furnishes communication between Territorial military headquarters and its widely scattered outposts, and for civilian purposes too. Of late, both the building up of the Alaskan defense machinery and a tremendous increase in civilian usage have greatly overtaxed the capacity of the existing telephone circuits.

When it became clear that expanded communication facilities would be required on this American frontier, Uncle Sam—in the name of the Alaska Communication System—came to the Bell System and asked its assistance in designing, building, and equipping a new line. Various units of the telephone organization, old hands at even such special tasks as this, coöperated to create this important voiceway in the far North.

In undertaking the project, the Army contracted with the Western Electric Company to supply the necessary equipment and to construct the line. In turn, Western Electric secured the assistance of representatives of the Long Lines Department of the A. T. & T. Company experienced in surveying, engineering, and building pole lines. The Bell System men also trained Army personnel in equipment installation and maintenance of outside plant construction.



In 1949, two Bell System engineers were dispatched to Alaska to survey the situation and then select a route and determine the type of plant advisable for the number of circuits required.

The route selected was from Anchorage, on the coast, to the tiny settlement of Tok Junction, some 330 miles inland. At this point it would join the existing Alcan line * that proceeds to Fairbanks, principal city in the interior, 205 miles farther north.

The new communication line would extend through a section of Alaska not previously served by telephone. Further, as this route would generally follow the Glenn highway, the line would have a road nearby for vitally needed maintenance purposes.

Aerial and buried cable and even a radio relay system were considered as possible facilities, but, because of difficulty of construction and the high cost of maintenance, these were not recommended. It was found, surprisingly enough, that sleet and ice conditions were troublesome only in a few areas and these for the most part could be avoided. Thus, open wire, plus carrier equipment, was selected to do the job. The Army approved this recommendation, and in August 1950 a quartet of Bell System men, myself among them, set out for Alaska to get the ball rolling. It was also decided that as much outside plant work as possible would be performed by contract, with Bell System people providing the technical and inspection services to insure a standard installation.

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* In 1942 and 1943, the U. S. Army had built a 2,000 mile telephone line—called the Alcan—from Edmonton, Canada, to Fairbanks, via Dawson Creek and Whitehorse.

Getting the Picture

Our first assignment, naturally, was to get acquainted with the country and our problem. How would weather conditions affect us and limit the working period? Were contractors available and would they take on our job? Were enough trained workmen available? What about local hauling facilities to handle our material and supplies? How were we to transport supplies from the States, and what about dock facilities in Alaska? Where would we live? These were only a few of our logistic questions.

To make matters more difficult, telephone communication with the United States was considerably overtaxed, and, as a result, calls were frequently delayed for long periods. Further, there is a five-hour difference in time between Anchorage and New York, and during Daylight Saving periods this is increased to six hours. Therefore, we either had a very short interval for transacting business or, as it turned out, someone at one end of the line lost quite a bit of sleep. Under these conditions, we soon decided that we needed teletypewriter service, which was installed.

We had to work fast, we realized, if construction work was to start the following Spring. Soon we were asking for bids and awarding contracts in order that a force might get started preparing right-of-way and carrying out field engineering. Those at home began lining up supplies, scheduling the manufacture of equipment, and attending to the thousand and one matters associated with the project. In early September, 1950, additional Bell System engineering field people arrived to help.

Alaska Line Time-table

1949

Preliminary survey of communication problem by Bell System for Alaska Communication System. Make recommendations.

1950

Engineering of line. Partial clearing of right-of-way. Start receiving material.

1951

Material received and distributed. Some re-engineering. Construction of line. Start buildings. Equipment installation. Training work.

1952

Final inspection of line. Finish buildings. Remaining equipment installation. Transmission line-up tests. Facilities turned over to Alaska Communication System in October.

Aerial photographs were made to assist us in selecting parts of the route and staking the line. They saved endless hours of tramping the brush and climbing mountains. Before we had these pictures, a "scout" would often beat his way up a mountain-side to what would look like a perfect location, only to find a lake, a swamp, or some other obstacle. Balloons filled with helium were also used, on occasion, to give a "fix" over heavy wooded sections or mountain tops.

A Race Against Time

Bell System people selected the exact location of the line but the contractor's crew "ran" the line, measured it, drove the location stakes, and recorded all the data. On September 9, 1950, field engineering got under way when the first stake was driven, and on the same date bulldozers started clearing right-of-way. We had 330 miles to complete before winter closed in and forced us to halt our work, and we knew we were racing against time.

To appreciate what all this meant, let me describe the northern world we had come to work in. Like many other people, I originally pictured Alaska as a huge expanse of bleak wasteland covered with ice and snow and inhabited, for the most part, by Eskimos. When we arrived, we found that we had to revise such notions, for although there was plenty of frozen tundra, there also were modern cities, fertile farmland, rushing streams, forests, and vast mountain ranges. Cities and farmland were in scattered locations, the areas in between practically uninhabited.

On this northern frontier, temperatures range from about 90 degrees above zero to a frigid 80 below. In the long winters, several feet of snow usually accumulate and the wind piles huge drifts in cuts and passes. Since Tok Junction is one of the coldest spots in Alaska, we started there and worked back toward Anchorage in the hope of winning our race against King Winter. As September advanced, the number of daylight hours dwindled and snow crept lower and lower down the mountain sides. As we came down the last mountain, some 60 miles from Anchorage, the snow followed the locating crews. During the last three or four days, these men used steel "bull" pins to make an opening in the frozen ground for the pole stakes. One crew finished its work with the snow falling so fast that it was nearly impossible to see from one range pole to the next.

A highway bulldozer and the cars of some Bell System people are halted beside Bear Cub Inn, a typical lodge along the route

Above: A contractor's trucks at a supply dump. Right: Stringing wire proceeds despite the depth of snow

Nonetheless, by October 28 we had staked the whole line and completed field engineering—a happy moment for us all!

What's more, we had also been able to provide Western Electric with preliminary estimates of the material we would require the following Spring. Only a little right-of-way clearing remained for completion in 1951.

Life Along the Route

Every 20 or 30 miles along the highway there are small frontier-style inns where the Bell System men stayed. Generally, there would be a main building (only two of them have baths) and two or three cabins where accommodations were adequate, although primitive. Once the novelty of the scenery wore off, life was pretty monotonous. However, for a number of weeks each year, gnats and mosquitoes did their best to keep things mighty active.

The high spot in the week was when we received laundry and mail from a courier service set up to de-

The repeater station at Tok Junction bears the name and insignia of the Alaska Communication System

liver supplies. We also received our pay from the courier but, curiously enough, when we were far from home, he was more eagerly awaited for news and gossip from the outside world than for that all-important envelope. That courier trip was a very rugged one—the car left Anchorage at about 5:00 A.M. on Friday and did not get back with its long list of items for purchase until late Sunday night.

Because of limited sleeping quarters and to minimize driving time, the five engineering crews were spread out over a distance of approximately 150 miles. We had the groups leap frogging into various sections as they progressed along the way, and by that method the various crews finished their jobs almost simultaneously.

The lodges along the highway could not accommodate the large number of construction people employed by the pole-line contractor, and he resorted to camps. Usually there were 70 or 75 men in a camp, which had floored tents, heated by oil stoves, that accommodated six to eight men. Modern mobile kitchens provided food. Setting up and moving these camps required the services of a special crew which was continually faced with the problem of finding sites with suitable and sufficient water for drinking and cooking.

With the exception of a little fishing, work and more of it was the order of the day. What with all the wild life in Alaska, we heard a good many bear stories, and at first everyone was a little concerned about meeting this "sport" in the brush. A contractor in New York wired us a tip that each man should wear a tin can containing small rocks which would

Long span construction makes it up the hill in one jump

rattle as he walked, and thus scare away any lurking bears. However, after receiving this enlightening information, we read in an Anchorage paper that two prospectors, equipped with "bear scares," nonetheless found themselves surrounded by bears. Luckily, they carried a rifle and shot two bears and escaped. After that we gave up any faith in tin cans and rocks. Actually, we saw few bears, and they didn't bother us—nor we them.

While in the north, incidentally, we came into contact with one feature of Alaska life which we had read about. Naturally, there is the greatest interest in the moment the ice breaks up in the Spring. Chances are sold and thousands of dollars in prize money are distributed in connection with the break-up of ice on the Tanana River. We found that a somewhat similar ice-break-up pool was held near us. Timing and recording devices are installed on a highway bridge not far from Palmer, to record when ice from

Wire for another long span installation is pulled across Eagle River

A homesteader's lonely cabin, not far from the new communication line

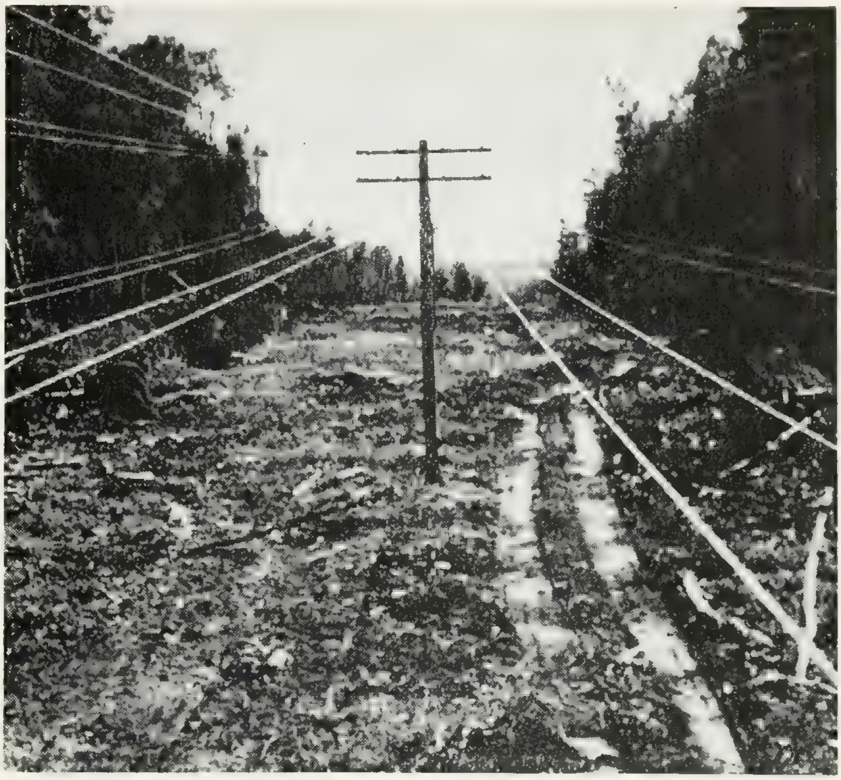
Lake George has broken up and comes down the Knik River to this point. We found that this big moment occurred in July. (P.S. Not a one of us greenhorns—or "cheechakos," in Alaska lingo—won a cent.)

Shipping Supplies in Winter

NORMALLY, construction materials are not shipped to Alaska during the winter months. Consequently, when they start arriving early in the Spring, the limited dock facilities are extremely congested. We therefore decided that if we were to be assured of having our supplies on hand by the start of the construction season, the following March, we would have to send them in during the Winter months. This decision, which created problems because of the extreme temperature, meant that we had to leave a Bell System representative in Alaska during the cold months to direct the work of stock-piling.

We found that only two Alaskan seaports could be used in the winter—Seward and Valdez. The latter port, about 115 miles away from the nearest point on our line, is wedged between high mountains and glaciers and has generally foul weather and heavy snowfalls. The steamship people expressed concern whether our heavy, bulky cargoes could be speedily unloaded in winter at Valdez, and were reluctant to take on the task during this period. After many conferences, in which we explained the importance of the new facilities and our reasons for shipping the supplies at this particular time, they agreed to take on the job.

About 70 per cent of our material was shipped to the port of Valdez. It is interesting to note we set a record for discharging cargo there when we reached a maximum of 30 tons an hour. The supplies were then hauled to a temporary stock-pile on an airfield a mile away, and finally were trucked from 120 to 380 miles further inland. All this was done in bitter cold when there were only three or four hours of daylight each day and it was necessary to use gasoline lanterns for light. Car and truck engines were kept running for fear the vehicles could not be started when they were needed and, at times, oil-burning torches were played on differential and transmission units to heat up the grease so that vital parts would function.



The new wires make an interesting pattern through the right-of-way cleared in the wilderness

Shipments consigned to Seward, 120 miles from Anchorage, were unloaded from the freighters and, as there was then no road to that town and our projected line, reloaded on freight cars. The supplies were then moved over the Alaska Railroad to four sidings in the interior. Here they were sorted for final on-the-job location and hauled to these points by truck.

Seventeen storage dumps were established, some 20 miles apart. Items requiring protection from the weather were gathered under large tents. With the ground frozen solid, it was a major undertaking even to erect such shelters. Steam had to be used to thaw out the ground sufficently to allow tent stakes to be driven, for example.

For eight and one-half months the hauling contractor's people were on the job every day, seven days a week. Crews were stationed at dock and rail discharge points for sorting supplies and loading trucks, while other men handled the unloading of trucks at final stock-pile locations. During the winter the contractor flew his unloading crews from one dump to another in a ski plane so that the men would be there when the trucks arrived. The plane would land either at the site of the stock-pile or on a nearby trail.

Heavy Snow Creates Problems

As we anticipated that the snow would hamper unloading and storage work, arrangements were made with the Alaska Road Commission to clear new snow from the material dumps at the same time they cleared the highway. However, because of particularly heavy and frequent snowfalls and the way the constant high winds piled up snow, we found it necessary to supplement their efforts by engaging privately owned bulldozers. But it was often difficult to find anyone willing to use his equipment in the extremely cold temperatures encountered. Perhaps the only redeeming feature of the heavy snow was the smoothness and good traction it gave to the road surface.

Bell System people in New York played a big part in seeing that supplies reached Alaska on schedule. It was their task to get items from telephone warehouses and more than thirty outside suppliers, to schedule the arrival of material at embarkation ports on the Northwest coast, and to see them properly loaded aboard ship for Alaska. In the end, all the necessary supplies were on hand at the proper locations when construction was started in the Spring.

A total of about 5,000 tons of material was shipped north—12,500 poles varying from 25 to 60 feet in length; 25,000 crossarms; 700 tons of copper wires; 2,400 tons of pole line hardware; approximately 65 tons of central office equipment; and miscellaneous supplies in addition.

After the 1950 "campaign," all but one of the men returned from Alaska. At home, some went back to their regular assignments while others worked up the final job specifications, transcribed field engineering data from notes to blue prints, and let the contract for pole line construction. As can be imagined, there were many conferences by representatives of the various organizations uniting to provide the new facilities.

Another group of Bell System people returned to Alaska late in March 1951 to start actual line construction. Two members of this party decided to take their wives and drive up the Alcan Highway. There was considerable speculation about the conditions they might encounter in the rough northern country, but the women entered into the trip with zest and the spirit of the covered wagon days. Except for one tough fifty-mile stretch, the road was fine and they didn't even have a flat tire.

The 1951 Campaign

In mid-April the line construction contractor began assembling his equipment and crews—which at one time reached a maximum of 170 people—and started distributing poles and hardware and fitting up crossarms. By the end of the month, he was ready to start actual construction. The first step involved placing a two-mile length of toll entrance cable between the Federal building in Anchorage and the new Alaska Communications office near Elmendorf Air Base on the edge of the city. From that point the men began setting poles to carry the open wire lines to Tok Junction.

Construction work, like that of staking the route, had all the difficulties and special problems summed up in the word "Alaska." The Bell System men and the contractor's crew labored along winding river valleys, on the sides of sharp bluffs, in canyons, in tangled underbrush, in frozen treeless tundra, and in swamps or deep forest it was necessary to master with axes and bulldozers. The men worked within sight of glaciers and mountain ranges snow-capped even in the brief summer. The line crosses two mountain ranges, and considerable maneuvering and effort were required to get equipment over the tops of some of the ridges. Sometimes the highway made for easy access to the scene of activities, but occasionally the men were forced to follow old trails, to cross lakes, and to struggle through damp or frozen muck.

The frozen, treeless tundra offered us special problems. The upper sur-

The line strides along on a series of peninsulas reaching out into Lake Mentasta—thanks to those who rebuilt the road

face of the tundra is generally covered by moss, saturated with water, which acts as an insulating material for a permanently frozen sub-surface called "permafrost." As long as this covering is not disturbed, the permafrost remains solid. In summer, although the top of the tundra thaws, the permafrost beneath ordinarily does not. Therefore, the surface water cannot run off or be absorbed, and the ground remains a soggy marsh, often several feet deep and all but impassable.

Fast-flowing, rocky streams, ravines, and steep descents were overcome by long-span construction. Twenty-two such long-span crossings, ranging from 400 to 1800 feet, were necessary. One river, which was 2700 feet wide, required us to build three 900-foot spans in tandem. Two intermediate fixtures were set in the water on steel piling driven in permafrost to a depth of 24 feet. To prevent possible damage from ice floes, ice breakers were constructed of steel piling and driven into permafrost around each fixture leg.

Earth-boring equipment mounted on caterpillar tractors was used primarily for hole-digging and pole-setting. In most of the localities where permafrost was found, the sub-soil consists of volcanic silt which, when frozen into a solid mass, makes a high-grade abrasive. This played havoc with the earth-augers, and when permafrost was encountered it became the custom to loosen up the soil with dynamite so that the drills could perform satisfactorily. Again,

Mantanuska Glacier proclaims to the telephone men that they are in strange territory

in a 25-mile area near Sheep Mountain considerable rock was encountered and this necessitated the use of dynamite for about 700 pole and anchor holes in that area.

Highway Shifts

In laying out the line, we had felt it imperative, of course, to stay close to the highway to facilitate construction and ensure easy access for maintenance purposes. However, in 1950 the Alaska Road Commission had been in the process of straightening out many curves, making short cuts, and resurfacing, and it had not completed its survey of a large portion of the new highway. Near Lake Mentasta, some 50 miles from Tok Junction, a new route which would reduce the length of the road by approximately 13 miles was planned but only preliminary plans were then available. Consequently, although we negotiated the region by tractor and obtained data on construction problems and estimated the materials needed, we were unable to complete our engineering work at that time. In 1951, we also found that the Road Commission planned to abandon 12 miles of new highway near Tok and that the Army intended to enlarge the Elmendorf Air Base and create Fort Richardson. Both of these changes required us to re-engineer and re-locate our line in these sections.

In realigning and rerouting the existing highway near Lake Mentasta, several large swamps were encountered. As these swamps were exceedingly deep, we had no recourse except either to drive piling for pole footings or to create earth fills running into the water. We decided on the latter, and arranged with the highway people for such construction. The peninsular fills extended approximately 30 feet from the highway shoulder and were about 10 feet across at the top. A total of 27 such fills were constructed in about a ten-mile section.

Training the Army

IT WAS DECIDED that Army personnel would install the carrier equipment under the supervision of Bell System people and in that way become familiar with the apparatus and learn something of its maintenance too. This necessitated our setting up a training school at Fairbanks. The "students" were later split into teams of Bell System men and Army installers who worked at the various repeater station installations. All trainees helped install the terminal equipment at Fairbanks, where the work was used as a sort of postgraduate course.

Thus, Uncle Sam has his new line—one carrying two crossarms with sixteen .128 copper weld wires, "point transposed" for J carrier operation. The telephone men have also lined up several carrier systems—four C systems from Anchorage to Tok Junction and one J system from Tok to Fairbanks. Repeater stations, of poured concrete construction, have been constructed at Sheep Mountain, Glennallen, Tok Junction, Johnson River, Big Delta, and Harding Lake.

Last October the Bell System turned over these additional and much-needed telephone facilities to the Alaska Communication System, and this vital link in the northern communication defense line went into service at once. To mark this occasion, an official call was made by the Commander-in-Chief of the Alaska Command in Anchorage, Lieutenant General W. E. Kepner, to Vice President F. W. Beirwirth of the Western Electric Company, in New York. Also present at the Alaska end of the line were Colonel Fred P. Andrews, the Commanding Officer of the Alaska Communication System, Colonel Otto W. Saar, the Theatre Signal Officer for the Territory, and H. N. Willets, representing the Western Electric Company.

THIS ADDITION to the far-flung communications network that the Armed Forces rely upon in protecting the nation represents more than the skill, experience, and energy necessary to the completion of any good telephone job. The men who created the new link left their homes for long periods to wrestle with harsh nature in a remote land. Theirs was a genuine sacrifice. But, to serve their country, they were glad indeed to build this new Alaska line.

Year-End Report

THE BELL TELEPHONE COMPANIES added one new telephone every four seconds during each working day of 1952, the American Telephone and Telegraph Company reported at the end of that year.

President Cleo F. Craig said "Use of the telephone continues to increase, and the Bell System Companies look ahead to another very busy year. To meet public demands and improve service further, all the Companies are keeping on with heavy construction programs.

"As our physical facilities grow," he added, "we are continually putting more new devices and equipments to work in the over-all telephone system. This is being done in accordance with long-range plans which, among other things, anticipate that ultimately telephone users will be able to dial their own long distance calls."

AT THE END of the year there were about 39,350,000 Bell System telephones in service, and people throughout the country were using them at the rate of 149 million conversations a day.

During 1952 the Company conducted a trial of customer long distance dialing in Englewood, New Jersey. Subcribers there have been able to dial directly to eleven million telephones in and around a dozen large cities from coast to coast. Results of the trial indicate the service is practical and fast.

Eight out of ten Bell System telephones were dial operated, as the year ended, and four out of ten long distance calls were being dialed by the originating operator directly to the called telephone.

New major long distance switching centers were placed in operation in Omaha, Houston, and Cincinnati. There are now 18 of these centers which, interconnected with other smaller systems, enable operators to dial through to distant telephones in 1,625 cities and towns.

About 3,100 miles of coaxial cable and radio relay routes were installed. Altogether, 16,300 route miles of these facilities provide thousands of long distance telephone circuits as well as 31,500 channel miles for the transmission of network television and theatre television programs over the nationwide system. Coaxial cable and radio relay extensions brought 14 more cities into the national television network.

THE COMPANIES went forward with new construction for which expenditures totaled approximately one and a quarter billion dollars. They added more than 1,900,000 telephones, installed 2,000,000 miles of long distance circuits, and cleared 850,000 requests for changes in service to a line with fewer customers or to an individual line. In rural areas, about a quarter of a million telephones were added, about half of them on lines with more than four parties, and progress continued in furnishing the kind of service where it is only necessary to lift the receiver to get the operator or dial tone. At the year's end, about 94 per cent of rural telephones were this type.

Among the many technical developments of the year was a new coaxial cable system with triple the capacity of those now in use. Designed by the Bell Telephone Laboratories, the "L–3" carrier will enable one pair of coaxial pipes to handle simultaneously more than 1,800 telephone conversations or 600 telephone conversations plus one television program in each direction.

Another Laboratories' invention, the transistor, was put to work during 1952 in the switching apparatus at Englewood. The transistor is a tiny electronic device which can do many of the things vacuum tubes can do and some things better. Licenses to manufacture transistors under Bell System patents were made available to 37 other companies by agreement with the Western Electric Company, whose own output has been mostly for military use.

Mr. Craig emphasized that "The telephone needs of the military and of defense industry will continue to get the promptest possible attention. The people of the Bell System," he said, "are deeply conscious that nothing is so important as the country's defense, and nothing is more important to defense than good communications."

Plans were completed for the maintenance of essential telephone service in the event of emergency. Aircraft warning systems were set up for Civil Defense and Air Force filter centers. The Bell Telephone Laboratories and the Western Electric Company designed and produced top secret electronic devices as well as guided missiles, fire control equipment for anti-aircraft guns, radar, atomic weapons, and a new field telephone for the Signal Corps. Assistance was also given the Signal Corps in the construction of vital long distance communications linking strategic areas in Alaska. For the millions of young Americans in uniform, more telephone facilities were made available in convenient, comfortable locations at their training camps and stations.

The number of Bell System employees, including the Laboratories and Western Electric, reached nearly 700,000. And not only were more people than ever employed in the business, there were more people than ever owning it. A. T. & T. shareowners passed 1,200,000, a gain of about 125,000 for the year.

"The tremendous rises in costs since the war are keeping the telephone companies under the necessity of obtaining increases in rates," Mr. Craig concluded. "This is essential to their being able to provide the kind and amount of service people need and want in the communities where they operate."

The Rate Engineers Seek to Implement the Objective of "The Most Telephone Service and the Best at the Least Cost Consistent with Financial Safety"

Design for a Good Rate Schedule

Helene C. Bateman

WHAT IS a good schedule of telephone rates designed to accomplish?

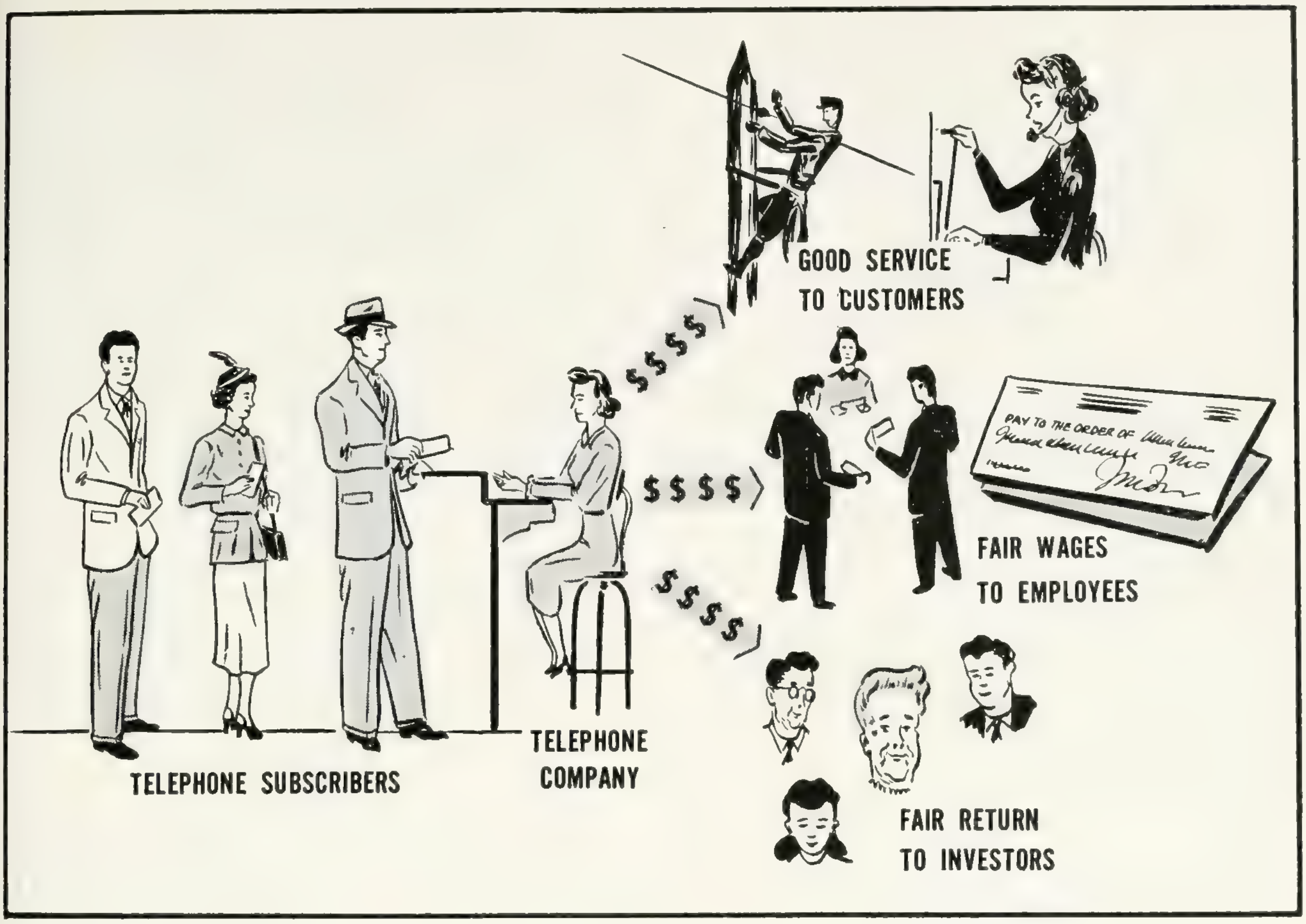
"Elementary," you say: "telephone rates are designed to bring in enough money to run the business; enough so that the company can furnish good service, pay fair wages, and earn a fair profit."

Very true, and most important. But a well designed schedule of telephone rates can and does accomplish many other things in addition to producing a given amount of money.

Unlike most other businesses, the telephone company is a public utility, with earnings limited by regulatory authority. Various rate schedules can be designed which will produce the allowed return, and the telephone company's greatest interest is to choose from among them the one which will best serve the public.

Such a schedule obtains the necessary revenues with the lowest practicable rates and in ways which will keep revenues as stable as possible, thus minimizing the need for future rate increases. It encourages more people to have telephones and to use them more. It meets the needs of groups of customers whose requirements are different from the average. It promotes a high quality of telephone service and at the same time helps to keep down the costs of furnishing it. And the distribution of charges among customers is fair and reasonable.

The first step in designing a schedule to accomplish all this is to set up the different classifications of telephone service. Unlike a department store, which sells a variety of articles as obviously different as pins and pianos, the telephone company has basically just one thing to offer: the means by which people beyond shouting distance can talk with one another. For pricing purposes, this one basic service has to be classified as



Adequate rates are the only source of money to give—
—good service to customers
—fair wages to employees
—fair return to investors

local or toll, business or residence, individual or party line, and so on.

The next step is to determine the type of rate to apply to each class; for example, whether a fixed monthly charge or a charge per message; if a message charge applies, whether it will vary with distance, length of conversation, or other factors.

Finally, the specific rate for each service item is determined, not in isolation but as an integral part of the entire rate schedule.

This is essential because no one talks to himself by telephone. Consequently, each customer's service depends on the service furnished to others. Rate treatment influences the amounts and types of telephone service customers take and the calls they make. So each rate in the schedule affects not only the customer who pays it but also every one who may want to talk with him.

Thus, through selection of the most suitable classes of service, types of rate treatment, and relative rates for the different classes, a rate schedule is designed which will best do its part in promoting the Bell System objective of "the most telephone service and the best at the least cost to the public consistent with financial safety."

To make this more concrete, let's join Jim Brown while he takes a look at his home telephone bill.

There has just been a big change in telephone service for Belleville, the small town where the Browns live. They now get local service to Fairview, the city where Jim works, and two small towns nearby. The telephone company calls it "extended area" service, but Jim and most of his friends talk about "toll free" service, because they won't have to pay the 10-cent toll to call Fairview, Springdale, or Brookside any more. Of course their monthly exchange rates will be higher. So Jim is looking over this first month's telephone bill more carefully than usual, to see how he is coming out over all.

Jim is pleased to see that his total bill is about the same as formerly—a little more than some months, a little less than others—although the family has been using the telephone a whale of a lot more. The monthly local service charge is up $1.50, but those frequent calls to his mother, who lives alone in Fairview, don't show up as tolls any more, nor the ones from Nancy calling him at the office to remind him what not to forget to bring home. Jim notices, too, that his calls to Bill Smith in Akron cost quite a bit less since he got Bill's number and places the calls station-to-station. The rest of the bill is about as usual.

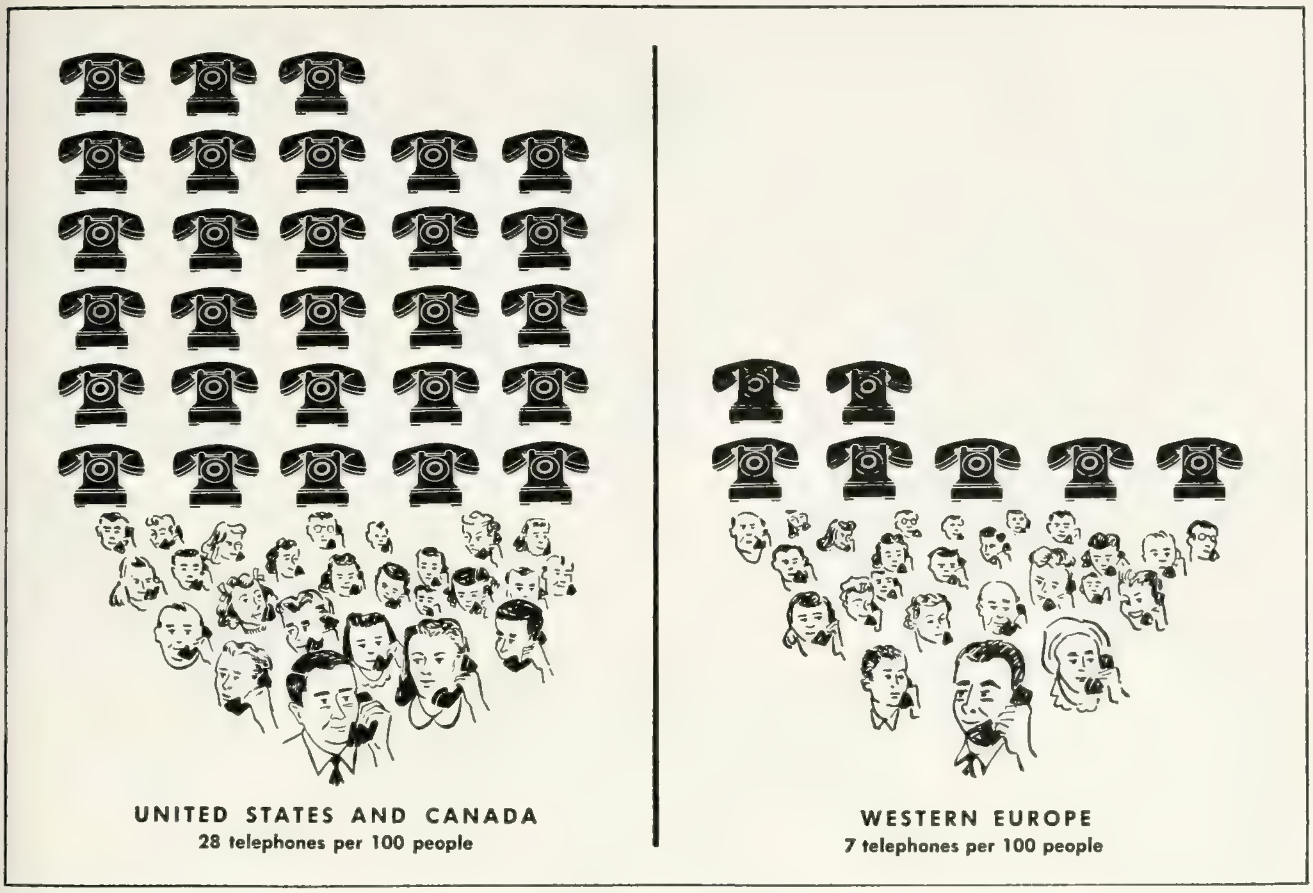
Does Jim Brown wonder why the rates for his main and extension telephones and for the toll calls he makes were fixed just the way they are? Or why they are different from the charges his boss pays for business service in Fairview? Probably not. Jim sees that his bill seems reasonable, and it's a very small part of the family budget, so he lets it go at that. Actually, Jim Brown's telephone bill is the end result of much time and thought by the telephone company's rate engineers to make sure that the new rate schedule will best accomplish all the objectives of good rate making. Let's review these objectives one by one, and see how this is done.

Adequate and Stable Revenues

Jim Brown's bill is higher now than it was before the war because with inflation his telephone company's costs of doing business have gone up and higher rates are necessary to produce adequate revenues.

It is not within the scope of this paper to discuss either the necessity for adequate revenues or the means of determining the amounts required. It must be emphasized, however, that the telephone company has no pass-key to Fort Knox. It has no means of obtaining revenues except through the charges paid by customers, and its dollars, like everyone else's, are worth only half what they used to be. So the rate engineers must be sure, first of all, that the new rates applied to the telephones in service and the chargeable local and toll messages will, in fact, produce the required amount of money—neither more nor less—as nearly as can be estimated.

The rate engineers also know that revenues from some types of services are more stable than from others. Toll traffic, for example, is greatly stimulated by such occurrences as the war in Korea and the consequent defense activities. Consequently, toll traffic and toll revenues may be expected to level off when these activ-



America has the highest telephone development in the world. A promotional rate structure is a big factor in this achievement

ities are curtailed. Revenues derived from monthly exchange rates, on the other hand, are less likely to be seriously affected. Incidentally, the probable stability of future revenues was one consideration, though a minor one, which favored eliminating the toll charge between Fairview and Belleville and substituting extended-area service covered by the monthly exchange rate.

The objective of adequate and stable revenues for the company does not conflict with other objectives which mean more and better service to customers. In fact, they are opposite faces of the same coin. If the company does not obtain adequate revenues, it cannot furnish satisfactory service. If customers are not satisfied, the company cannot grow and keep financially healthy. So, let's see how telephone rates do some of the other jobs assigned them.

More Telephones

ALMOST ANY BUSINESS likes to attract as many customers as possible, but it is only in the telephone field that the added customers increase the value of the product.

The Browns' refrigerator and washing machine do their work regardless of whether the neighbors have these conveniences or not. Mrs. Brown gets an extra kick out of her new fur jacket just because none of her friends has one like it. But, if the Browns' telephone were the only one in town, it would be of no use to them at all. It is more useful and worth more to them now than

Rates are designed to encourage everyone to use the telephone. "Nothing is more hopeful for the future of our business than the intense interest and desire of young people to use the telephone" it was a few years ago, because the baby sitter, the handyman, and lots of other people they want to call have had telephones put in recently. So rates which attract more and more new telephone subscribers benefit not only them but also all other telephone users.

What are the rate treatments especially designed to do this? One is the classification of telephone service between business and residence. The telephone is of great value to business concerns, large and small. It brings in customers and saves time and money far in excess of telephone charges. So almost any business man would think it very poor economy to try to get along without a telephone. On the other hand, some moderate-income families might not feel able to afford telephone service if residence rates were the same as those charged business establishments. So basic residence rates are made lower than business, in order to build up a large residence development. This, in turn, benefits the business customer and is the reason why the Browns' home telephone costs less per day than does a pack of cigarettes.

Another way of attracting low-income families to join the telephone system is by offering party-line service. In Belleville, four-party residence service can be had for $1.75 a month less than the Browns' individual line. It may be this very low rate which encourages the Browns' baby sitter and handyman to have home telephones.

These types of rate treatment, designed to encourage residence development, have been common for many years in this country. In many European countries, by contrast, business and residence rates are the same, and party-line service is rarely furnished. This may account, at least in part, for the fact that so many more of the homes in this country have telephone service.

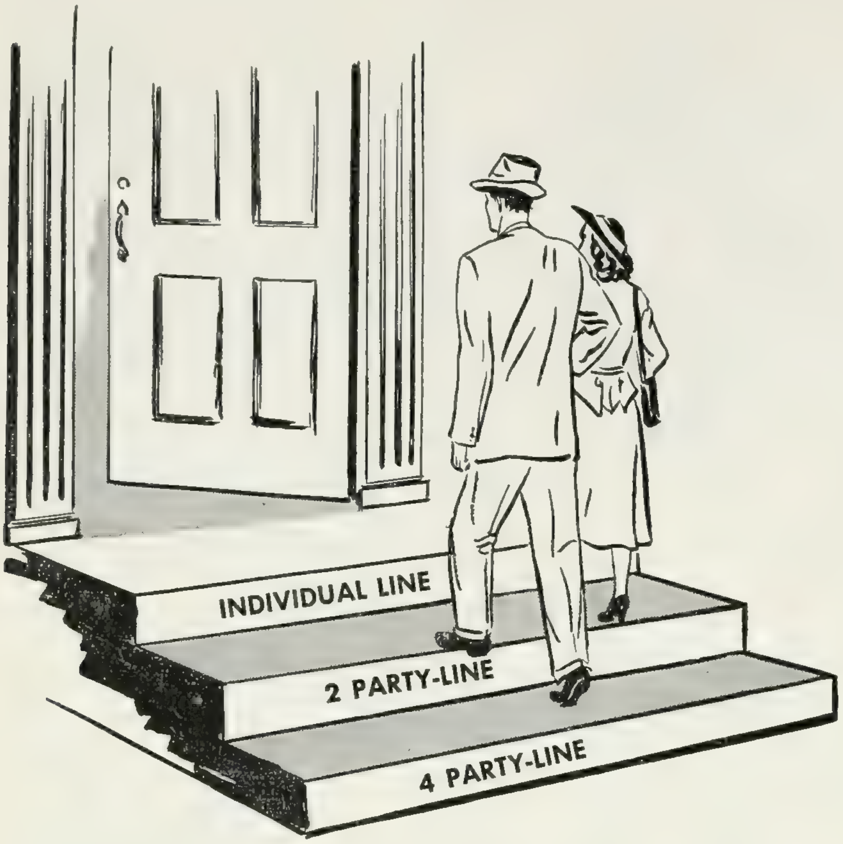
Promotional rates are available to business as well as residence customers. In Belleville, for example, most business customers have flat-rate individual-line service, entitling them to an unlimited number of local calls. In addition, to make sure that every business man has a high-quality telephone service within his reach, the telephone company also offers a business message-rate service at a low monthly rate for a limited number of local messages, with an added charge for each additional message. Even the smallest business can afford this service.

More Telephone Calls

Bell System rate schedules are designed to encourage people not only to have telephones but to use them; to make telephoning an essential part of their everyday way of living and doing business.

Even the seemingly useless calls—Johnny chatting with the girl friend, Betty and Joan giggling over their homework, little Susan babbling to grandma—are important to the people involved. The more that people use their telephones, the more satisfaction they get from them and the more anxious they are always to have a telephone.

"Flat rates," which permit customers to make as many local calls as they wish at a fixed monthly charge, are the most effective means of encouraging customers to make the greatest use of their telephones.



Rate schedules are designed to make it easy for customers to step up from party line to individual line as their requirements increase

They are particularly effective in the case of residence service. Experience indicates that residence customers with flat-rate service make about twice as many local calls as those who have message-rate service.

Customers like flat-rate service and are willing to pay the higher rates required because they enjoy freedom of use and get so much service. Take the Brown family, for instance. Jim Brown likes their flat-rate service because he knows in advance just what his monthly local charge will be and he doesn't have to check up on the youngsters to keep them from running up his bill. Mother certainly appreciates it when she has to call a long list of club members. Johnny and Betty are sure their social lives would be wrecked without free access to the telephone. Even five-year-old Susan rounds up the neighboring cow-girls by telephone.

This is all to the good as far as the telephone company is concerned. Nothing is more hopeful for the future of our business than the intense interest and desire of young people to use the telephone.

Extended-area service is another type of rate treatment designed to encourage greater use of the telephone. Where there is a good deal of community of interest between towns, customers are glad to pay a somewhat higher monthly charge for the wider calling privilege. With the new extended service, Jim Brown will call his mother every evening from now on. Betty hopes several boys in the other towns are going to call her for dates. Mrs. Brown will do more of her out-of-town shopping by telephone. Even if the extended-service charge is a bit higher than their former local rate plus former toll charges, no one minds, because they will all get so much more for their money.

Special Services and Facilities

Some customers have needs for special services or for facilities different from those of the average telephone user. The telephone companies try to meet such special needs as far as is practicable without burdening the great majority of customers by having them pay for costs incurred for the benefit of a few.

Grandma Brown is quite deaf, and her telephone is equipped with an amplifying device. The flat monthly charge for this special set is kept very low, not only for the benefit of those with hearing defects but also in the interests of all other customers who may wish to talk with them.

On the other hand, the X.Y. Co., the large manufacturing concern for which Jim Brown works, has a rather elaborate intercommunicating network specially designed for its plant. The charges for this recognize the various service features, and their levels are commensurate with the high value of these special arrangements to the X.Y. Co., since they add little to the service of anyone else.

High-Quality Service

Good telephone service depends primarily, of course, on the operators, maintenance men, service representatives, and others who day by day work together to furnish it. Yet a well designed rate schedule can also help ensure a high quality of service by offering only those classes of service which have proved generally satisfactory and by influencing the amounts and types of service which customers use. For example, the differentials between individual-line and party-line rates are fixed at levels which, in normal times when facilities are available, encourage customers to proceed naturally from party to individual lines as their needs increase.

When the Browns were first married, they were on a party line. As the family grew and their telephone use increased, they found it cost only a little more to change to individual-line service. If the rate difference had been too great, the Brown family might have stayed on the party line; and as their use increased, a generally unsatisfactory service situation might have developed.

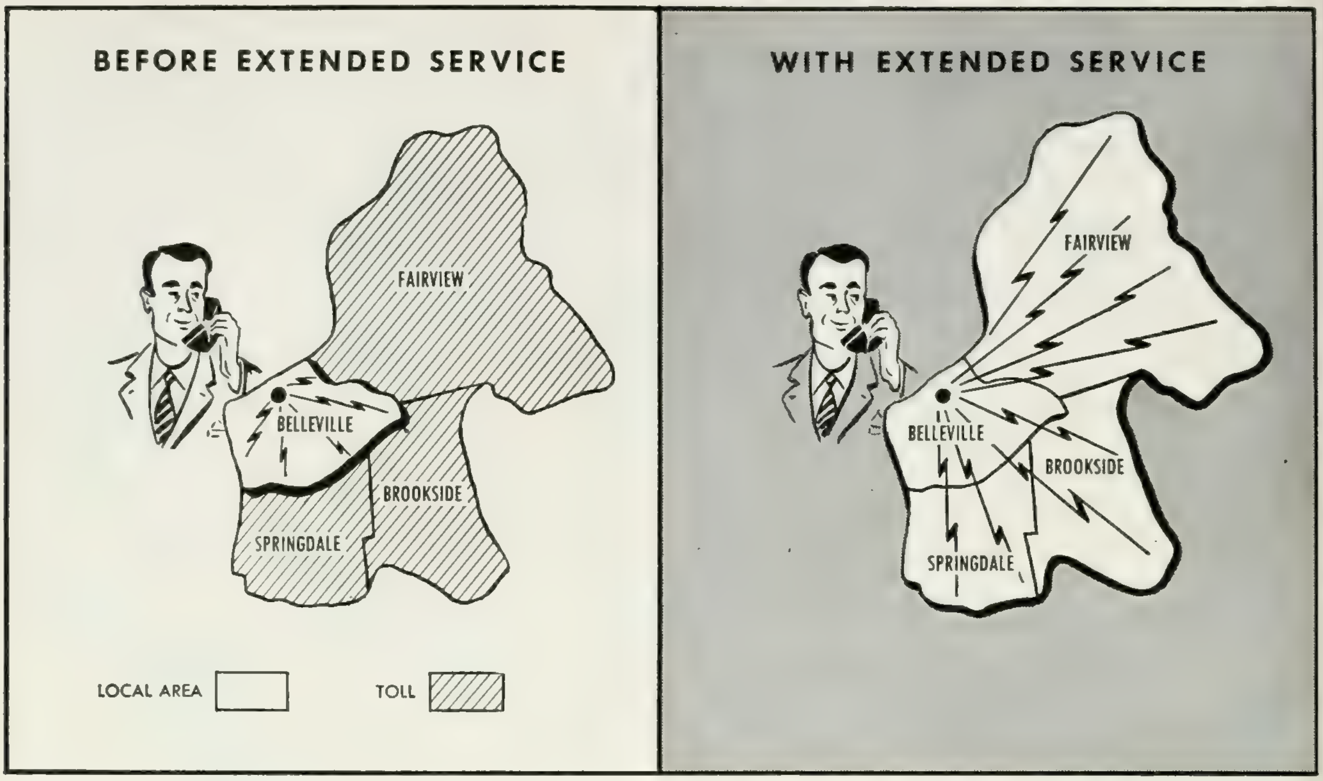
Unfortunately, in the present period of shortages, it is not always possible to give all customers the type of service they need and desire. However, rate schedules are designed so that rate differentials will present no obstacle to customers taking better grades of service as soon as facilities are available.

Contrast between American toll rate schedules and those in effect abroad furnishes another illustration of the relation of rate treatment to quality of service. Most foreign toll schedules provide for "express" and "lightning" calls at progressively higher premiums over the rates for "ordinary" service. The American toll system, in effect, provides "lightning" service on all calls and no rate premium is charged.

Keeping Costs Down

Neither the telephone company nor its customers want to sacrifice good service in an effort to cut costs. But rates can help avoid unnecessary costs.

For instance, some time ago Jim Brown made a call to Bill Smith in Akron without knowing where Bill was staying. Several operators did a lot of work and used expensive long distance circuits and switchboard facilities before Bill was finally located. The next time, Jim got Bill's telephone number from Bill's secretary



Extended service gives the customer many more calls at a lower cost per call to both company and customer

and placed the call station-to-station. The call went through much quicker, Jim saved money, and the telephone company saved a lot of operators' work and circuit time. Now Jim clearly sees why the station-to-station rate is made substantially lower than the person-to-person rate, in order to encourage customers to place their calls on a station basis whenever possible.

Sometimes a type of rate treatment reduces unit costs by making more service available at about the same total cost. The extended service between Belleville and adjacent towns is a case in point. The Company saves operating, accounting, and other work because calls to these points can now be dialed by customers and it is no longer necessary to ticket and time the calls, compute and bill charges, and so on. On the other hand, with extended service, customers make a lot more calls, and the company has to provide the circuits and other facilities to carry the additional traffic. These added costs may amount to somewhat more or somewhat less than the savings, but, in either case, customers get much more service (sometimes five or six times as much) and the cost per call is 'way down.

Fair Distribution of Charges

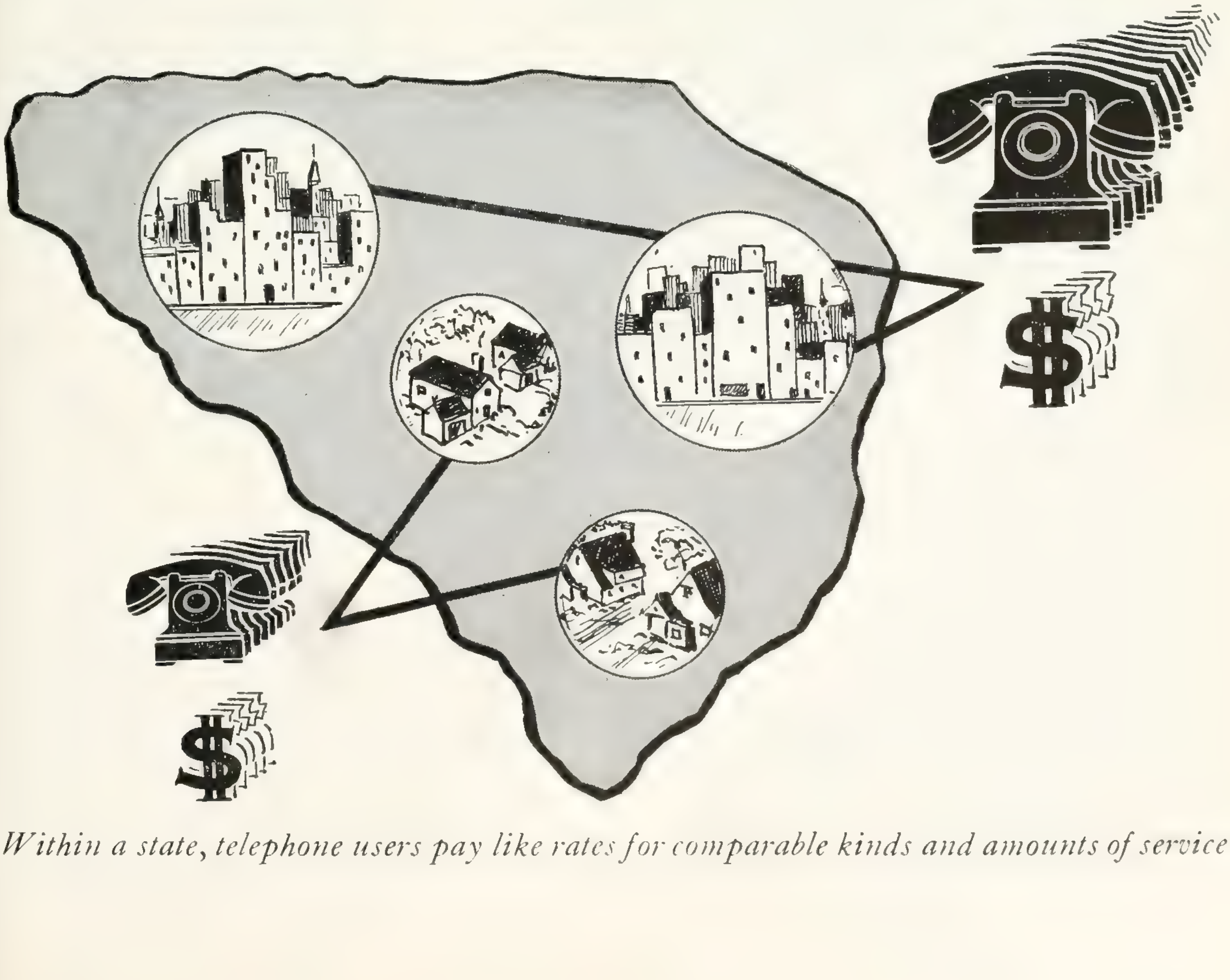
TELEPHONE RATES are applied in accordance with established tariffs which clearly set forth the classes of service offered, the rates for each class, and the administrative regulations. This ensures fairness through the uniform application of the schedule to all customers.

Fairness also requires that important differences in service be recognized by differences in rates. Party-line customers pay less than do individual-line customers, obviously, because they share the use of their line. Business customers pay more than residence because telephone service is more valuable to them and, as a group, they use it considerably more. Toll charges increase with length of haul and length of conversation.

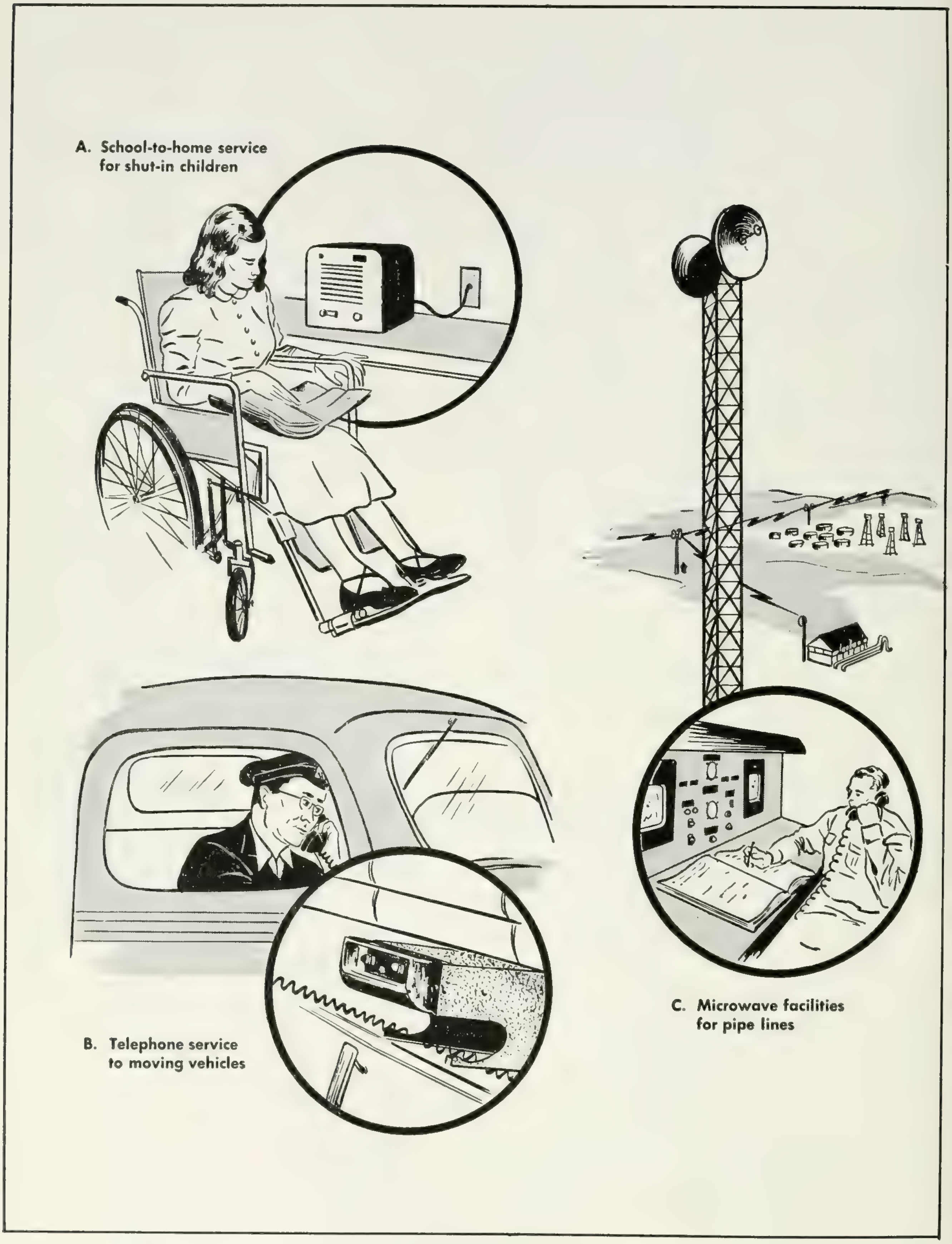
On the other hand, attempts to recognize too many minor differences would result in rate schedules so complicated that customers would not understand them and the company would find them difficult to administer. Any workable rate schedule requires grouping of customers and a certain amount of averaging out of charges. Equity requires that these groupings be reasonable, based on type, amount, and scope of service, and that customers who receive the same or closely similar services under like conditions pay the same charges.

An illustration of this is the gradation of exchange rates in accordance with number of telephones available. With their new extended-area service, the Browns can reach 40,000 telephones without a toll charge. The telephone company makes the same charge to every other family in the state which has the same class of service as the Browns and, like the Browns, lives in the built-up portion of an exchange with about 40,000 telephones available at local rates. Similarly, in the toll rate schedule within the state, the same rate applies for calls between points the same distance apart. Obviously, these are fair methods of charging.

It may be well to mention here that a fair distribution of charges does not require that each individual or each group of customers pay charges based on estimated costs of serving them.



Within a state, telephone users pay like rates for comparable kinds and amounts of service


A. School-to-home service for shut-in children
B. Telephone service to moving vehicles
C. Microwave facilities for pipe lines

Telephone companies offer facilities and services at appropriate rates to meet the needs of customers who have special requirements

The great bulk of the telephone company's costs for basic services are incurred in order to make it possible to connect any one telephone with any other, and in making these connections, on demand. Such costs are common to everyone and to try to separate them is like trying to unscramble eggs.

Furthermore, attempts to base rates entirely on estimated costs would more often than not react greatly to the customers' disadvantage. Take Joe's market, where the Browns buy most of their food, usually ordering by telephone. Someone might figure that it doesn't cost much to serve Joe, because the market is right next to the central office and Joe doesn't make many outgoing calls. The Browns live in the newer part of town and their youngsters make lots of calls. So the costs of serving the Browns and many of their neighbors might seem rather high. If rates were based on these estimates of costs, Joe's telephone bill might go down several dollars a month, it is true, but he would hardly notice the difference in his total cost of doing business. At the same time, the telephone rates for the Browns and their neighbors would go 'way up. Some of them might have to give up service or change to a busy four-party line. Rates based on costs would obviously be bad for them. But they would be bad for Joe too, because he would miss much of the business they used to telephone in. Joe would much rather pay his present rate and keep his telephone busy with incoming orders.

Weighing the Various Objectives

Perhaps this brief discussion of the various objectives of telephone rates leaves you with the impression that sometimes they pull in different directions. Indeed, sometimes they do. The best quality service is usually not the least costly. Rate treatment designed to encourage maximum use as to number and duration of calls and extent of area covered, if carried to too great lengths, might require rate levels which would not permit the maximum number of customers to have service. To cite an extreme—we obviously couldn't offer nationwide flat-rate service.

There is no magic formula for resolving these cross-purposes. The rate engineer studies past experience with various service offerings and rate relationships in his own and other territories. On the basis of this experience he weighs the pros and cons and attempts to arrive at the schedule which, in his judgment, will be most satisfactory from all standpoints.

The answer isn't the same at different times or in different areas. Different circumstances and conditions, and customers' habits and preferences, all have to be taken into account. By way of illustration, when both flat and message rates are offered, in some areas almost no one takes message-rate service while in other areas there is a fair amount of measured service. Similarly, many residence customers, in some areas, seem fairly well satisfied with party-line service while in other areas relatively few consider this service adequate. These and many other differences in customer attitudes are taken into account in designing the different rate schedules.

Another important factor is the relative levels of revenue requirements in different states. Since intrastate service in each state and interstate toll service are subject to different regulatory authorities, each must stand on its own feet financially. Differences in revenue requirements may affect rate structures as well as rate levels. For example, in one state, individual line and two-party flat rates may be low enough to promote a large residence development. In another state, where rate levels are necessarily higher, four-party flat rate or two-party message rate service may be added at lower rates to attract low-income customers. An independent company operating two or three small exchanges must view its rural rates as its major source of revenue, while to a company operating in large cities this would be less significant. These differences must be duly recognized in the rate schedules in order that each company may meet its revenue requirements in each state.

THE major objectives of rate making are always the same: "The most service and the best at the least cost to the public consistent with financial safety." Since conditions may differ widely, rate engineers strive not for uniformity of rate schedules but to develop the best possible solution to the rate problems of each area, so that all may accomplish the basic objectives to the greatest possible extent.

Merry Christmas!

In recent years, the evening cheap rate for trunk calls has been suspended throughout the United Kingdom on three days at Christmas and on New Year's Day, with the object of freeing from duty on those days some of the evening operating staff.

For the past two years, however, in order that staff relief could be given on the days most appropriate to the staffs north and south of the Border, the suspension was: Scotland—25th and 31st December and 1st and 2nd January; Rest of U.K.—24th, 25th and 26th December and 1st January.

This arrangement has proved to be more satisfactory. On these evenings, traffic levels were 25 to 40 percent below those of a normal evening and, in general, each member of the operating staff was free on at least one of the holidays.

From *Telecommunications* of the United Kingdom Post Office

Despite Specialized Equipment and Modern Methods, It Is The Man on Foot or on Snow Shoes Who Closes the Gap And Maintains Service Where the Snow Lies Deep

Operating in the Hazards Of Deep Snow

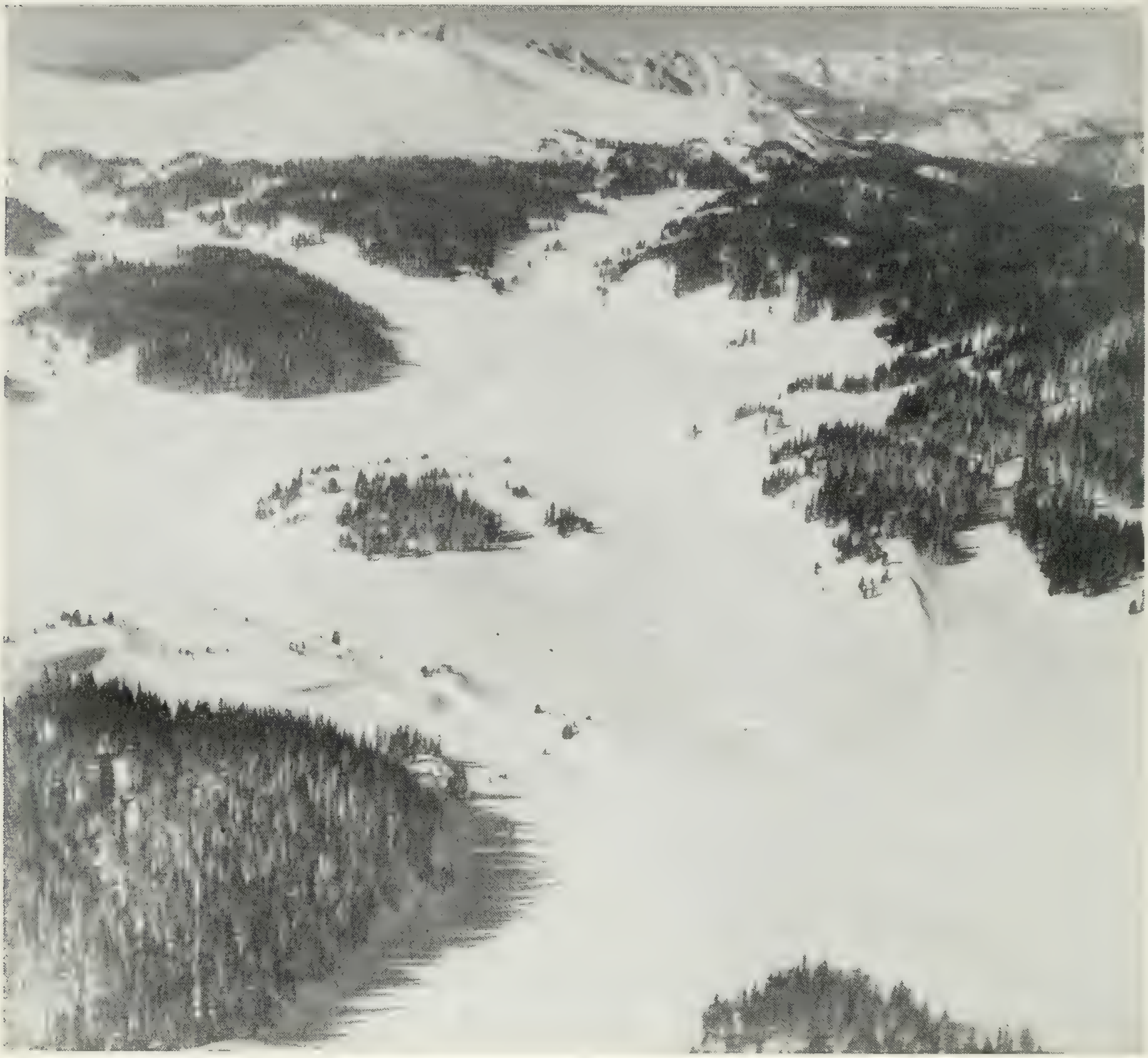
Stuart Shaw

Winter comes to all the Bell System's Associated Companies, but some get more than others. The one which gets the most, and encounters the most spectacular problems, is probably The Mountain States Telephone and Telegraph Company, whose territory extends from the Canadian border to the Mexican, and embraces the Rocky Mountains. So for our Winter issue we solicited from that Company the following description, in words and pictures, of what it is like to carry on in the high, cold, snowy country which it serves. EDITOR.

SNOW had started falling early last winter on Elwood Pass, nearly 12,000 feet above sea level in the rugged mountains of south-central Colorado, and by Christmas of 1951 it had reached an actual measured depth of 12 feet on the level—only there wasn't any level. It was all up and down, and violent winds had created mountainous drifts.

The Denver-Durango toll line of The Mountain States Telephone and Telegraph Company, that connects Durango, Colo., with larger centers on the eastern slope of the Rocky Mountains, had gone out of service late in December. Of course there were other ways to get in to Durango telephonically: down from Grand Junction on the north or up from Albuquerque, N. M., on the south. In addition to through carrier circuits that were quickly rerouted over a round-about path, this line carried two physical circuits and one phantom circuit, and the loss of these facilities would be felt—what with toll usage on the up grade.

The trouble lay in a 17-mile section of line between Pagosa Springs and Alamosa that follows an old wagon road over Elwood Pass. The



This is Elwood Pass a mile East of the top. The telephone pole line, extending from the bottom center of the picture to the upper right, passes the Elwood shelter cabin in a clump of trees at the left just before the line enters the heavy timber

modern automobile highway, constructed since the telephone line was built, follows a different route in this section. The result was that for years the winter maintenance on this section of line had to be carried out by men on snowshoes. Relief cabins stocked with provisions were located on the route, because going in there in winter involved a trip of several days fraught with danger from snowslides, extreme weather, and exhaustion.

These hardships are not new to Mountain States men, for they have faced them over the years in many crossings of the main range of the Rockies. They were first faced 'way back in the '80s when a line was built over Mosquito Pass to reach the booming mining camp of Leadville and connect it with Denver. They occurred again on Imogene Pass, between the mining towns of Ouray and Telluride, Colo.—but that line was rolled up and abandoned a number of

This is Elwood Pass as it starts down the West side of the mountains. Here too keen eyes will find the pole line running from the bottom center of the picture diagonally to the right to disappear among the trees in the background

years ago in favor of easier available routes.

And they were present on inaccessible Argentine Pass, at 13,000 feet above sea level, where the line was even buried underground to keep it in place—only to have the mountain rats eat off the insulation so it had to be brought above ground again and heavy conductors placed on heavily guyed poles to resist the arctic conditions. The Argentine Pass line was replaced in 1940 by one over Loveland Pass at 12,000 feet that follows the main automobile highway between Denver and Grand Junction and is never far from the road. As a matter of fact, this latter line gives little trouble because of its heavy construction, although occasionally a snowslide comes down and simply moves off with a whole section of it, poles and all.

It is only natural to wonder why, over the years, telephone lines have been built in such difficult places, where men have to go afoot to repair them. It is because in the early days they were built to reach the mining camps and the mining camps were where the ore was. Wagon roads were built between these camps, and the telephone lines quite naturally followed these routes. Then along came the horseless carriage, and better roads were developed over more favorable routes during a period of a good many years, and the telephone lines were frequently left on abandoned roads that became little better than foot trails in some sections. Rebuilding those lines over new routes has been carried on gradually, but it is an expensive business.

IN SPITE of every effort on the part of telephone crews operating from Alamosa on the east and Durango on the west, winter ruled supreme on Elwood Pass. Using the experience and the equipment that have proved effective in other years, local repair forces and construction crews were still unable to penetrate the mountainous drifts and dangerous slide areas that locked this section from the outside world. It took 58 days to get that toll line back in service.

Photographs taken from the air indicated that in places the line was completely buried in the snow and that in numerous instances large trees had been carried down by the weight

Pack trains have been used in the past to get supplies in to telephone jobs

Dog teams have served a need also—as here on Cottonwood Pass

of snow and the wind and had fallen through the line, breaking or short-circuiting the wires.

Even the Company's Sno-Cat, a 4,000 pound juggernaut with four powered pontoons and cleated tracks, couldn't penetrate the winter wonderland west of Alamosa.

Built especially for winter toll line patrols, and so powerful that it can pull itself out of almost any difficulty encountered on the trail, the Sno-Cat had mastered the snow conditions of other years. Even in this case it might have rammed its way through some of the deep drifts created by 12 feet of snow driven by 60 mile-an-hour winds. But the end wouldn't justify risking the lives of men. The crew would be in great danger at many points from snowslides that would start at a whisper, as well as from the chance of upsetting the vehicle on the heavily drifted shelf roads skirting perilous cliffs.

The 'Cat is able to carry four men in an aluminum cab which is completely inclosed to shield them from the weather. It contains a heater and sleeping bags, air mattresses and food supplies for emergency. When needed, a ski-equipped trailer capable of carrying over a ton of supplies can be towed behind.

But the 'Cat was unable to travel on the steeply inclined snow where it had drifted in on ledge roads. Some thought was given to bringing dog teams up from Aspen, but the danger would still be there, as slides were running constantly. Supervisory people decided that the risk of sending men in there was too great.

It was a good, real-life illustration of our well-known statement of principle that "No job is so important

The Sno-Cat is today's answer to the challenge of the steep and snowy slopes and passes

and no service is so urgent that we cannot take time to perform our work safely."

When snowslide conditions became somewhat less hazardous, bulldozers were called in and set to work from both ends of the closed section, clearing out the road. It was slow business, and dangerous too. Slides were still a threat, and with almost continuous snow storms, roads drifted in behind the bulldozers.

Finally, after 58 days of work and wait, of advance and retreat, the crews reached opposite sides of the three-mile section covered by McCormack Slide. Oh yes, these slides "run" in the same places every year and have names—nicknames, even—and there is much spirited wagering on when this one or that one will "run," that is, come thundering down a mountain carrying everything before it, snapping off trees like matchsticks. McCormack Slide is always too dangerous to be covered in any way but afoot and *carefully*. That was done in this case.

And so on February 18, 1952, the last splice was finally made and the precious thread of communication was restored.

A sample of the conditions encountered is revealed in the log of one of the crews that related laconically under date of February 8, 1952:

"Took 14 trees out of line and cleared 137 wire breaks yesterday and today."

You ask, "Is it worth it, just to enable people to talk to one another?" Well, telephone men have thought so for quite a few years now, and will probably go right on thinking so.

But it is not too surprising to learn that the death sentence has been passed on part of this line. The through service will be provided by a modern carrier system over a more circuitous route.

At the time the line over Elwood Pass was restored, actual snowfall in the area had been measured at 500 inches, or *more than 41 feet*! Of course it had packed down, but that was the cumulative total measured after each fall.

Such figures and descriptions may give an entirely false idea of winters in the Mountain States area. Although arctic conditions are the rule at 10,000 feet or above, residents of Denver and other plains cities about 5,000 feet didn't shovel their side-

But to reach the wires, in many places, the weary miles still must be covered afoot

The Winter snow piles deep

walks more than two or three times last winter, and on a few occasions whisked off light snow with a broom.

In the same period of the Elwood Pass difficulty, a telephone crew was out for several days when service failed on Cumbres Pass, between Antonito, Colo., and Chama, N. M. Out of 25 miles of line, five miles were completely buried and out of sight under the snow.

Overtaken by a severe blizzard through which they could not proceed, this crew was compelled to spend the night in the Sno-Cat, where they made good use of the emergency rations and sleeping bags carried for just such a purpose. Telephone people at Alamosa became alarmed at failure of the crew to report in by telephone, and sent out an airplane the next day which located them and determined that they were not in need of help.

During the time this line was out of service a radio channel was utilized to connect the facilities of the independent company at Chama to the general telephone network at Sante Fe. The radio link has proved a useful addition to the facilities available to Chama, and plans are under way to continue radio operation in the Sante Fe—Chama section.

On another occasion last winter a dog team of Alaskan Huskies was chartered and used successfully to transport men and supplies to repair line breaks on Cottonwood Pass in central Colorado.

No doubt the most difficult crossings of the mountains are to be found in Colorado because they are the highest, but severe weather conditions occur in other states of the Mountain territory, notably Utah, Wyoming, and Montana, with a little of it in Idaho, too.

Blizzards on the Wyoming plains can be sudden and treacherous, but the greatest snow difficulty is encountered over in the Jackson's Hole country, a famous dude ranch and hunting area. Every winter some trouble occurs on Two-Gwo-Tee Pass between Lander and Jackson. A Snoplane is used in this area for transportation over the heavily drifted snow. It is a cab on skis that is driven by a motor and airplane propeller. It carries two men.

A motor driven toboggan with cleated track has been used with some success in Idaho.

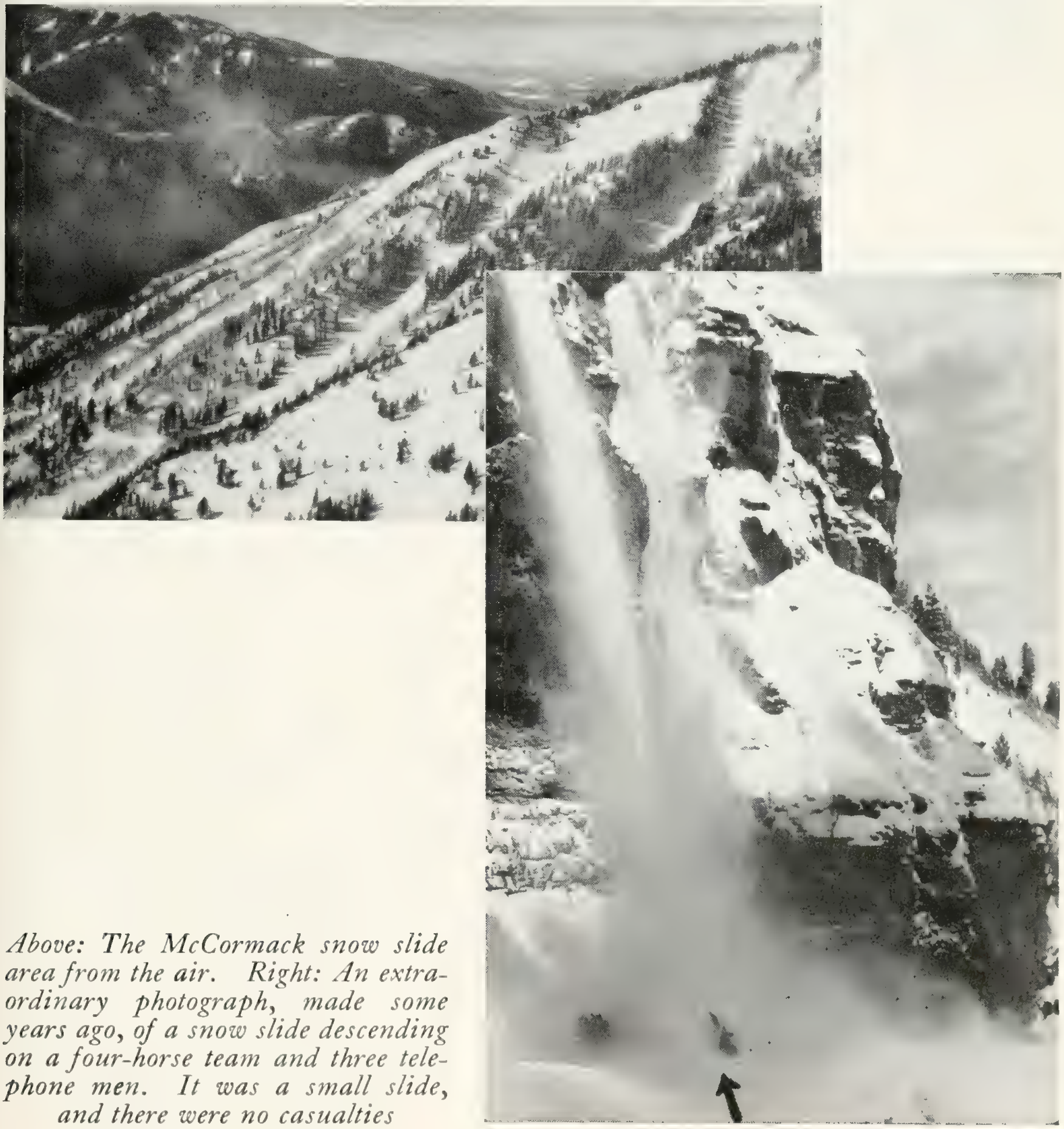
The reason for different mobile equipment in different areas is that snow conditions vary by localities.

Surprisingly enough, the telephone

maintenance people in Montana will tell you that it is not a "snow country." Sure, the temperatures are low now and then, they say, and snow may drift over the roads, particularly in eastern Montana. The Sno-Cat that was stationed at Helena last winter was used only once, and that was in rescue operations after an airplane crash high in the mountains. This winter the Montana people planned to station the 'Cat in eastern Montana, probably at Glasgow, where it would be of more use when roads drifted in and were blocked to automobile travel.

A wide right-of-way has been cut through trees on the Helena–Salt Lake City toll line so that it is relatively trouble-free.

Some trouble is encountered on the line between Logan, Utah, and Montpelier, Idaho, of some forty miles over the mountains. In the past it



Above: The McCormack snow slide area from the air. Right: An extraordinary photograph, made some years ago, of a snow slide descending on a four-horse team and three telephone men. It was a small slide, and there were no casualties

In the end, it is men on foot or on snowshoes who actually join the broken threads of communication

was cleared by men on snow shoes, but for the last two years a motorized unit called the Sno-Shu has been helpful.

Greatest winter maintenance trouble in Utah occurs between Provo and Price on the Denver–Grand Junction–Salt Lake toll line. The line ranges up to ten miles from U. S. Highway 50, reaching an elevation of 10,185 feet at Mapleton Canyon. It continues down to an elevation of 7,477 feet at Soldiers Summit and on into Price. From January to June of 1952 there were 14 total failures in this section. In some instances 25 and 30 foot poles were ten feet under the snow, with resultant broken poles, crossarms and wires. Restorations were made with twisted pair and spiral-four cable. In many places on this line the terrain is so steep that only men on snow shoes can reach the line, and transportation of material is a problem.

Despite this emphasis on the spectacular, we are gradually getting rid of our most difficult winter maintenance problems, either by rerouting lines so they are more accessible from highways or by utilizing results of the latest research in carrier systems, which permit their use over circuitous routes.

Yet even with the help of motorized equipment and modern methods, in the final analysis it is, as it always has been, the man on foot or on snow shoes who actually closes the break and restores the flow of communication so that other men and women may go on talking with each other across the length and breadth of the land.

Advance Planning for Retirement

Laurence N. Roberts

Mr. Roberts was employment activities supervisor of The Pacific Telephone and Telegraph Company at the time of his retirement on June 30, 1951. He had long been active in the work of the Telephone Pioneers of America, and was a vice president of the Telephone Pioneers Association. The following paragraphs are quoted from The Telephone Pioneer, *quarterly publication of that organization.* EDITOR

RETIREMENT!—what a word! To some, it appears to mean the end of everything; the end of their life's work, with nothing further remaining to achieve. To others, "retirement" is a technical word, applied to the completion of one phase of their careers. It is not the end of life; not a time to fold the hands and wait.

Our real endeavor at retirement should be to continue to try to bring into fruition the purpose in life we have been striving all along to accomplish. Our problem now, as Dr. Harry Benjamin reminds us, is "not to add years to our life, but to add life to our years."

So much for what retirement means. Now comes the question: What steps can we take to prepare for it? What are the basic things we should consider in making our plans?

1. Start planning early.
2. Enjoy living.
3. Keep your plans within your physical ability.
4. Make your plans fit your income.
5. Have a hobby.
6. Have an objective.
7. Stay where your roots are down.

Start Planning Early

IN A MEASURE, in entering upon our new career we face the same problems we faced when we embarked upon our first. If we were not prepared, if we had not adjusted ourselves to life, we had a long, hard struggle to make up for our deficiencies. The adjustment to our new career will be easy or hard, short or long, depending upon the same factors.

Intelligent planning in advance will not only prepare us for the change, but will help us to know what we are going to do and how we expect to accomplish it. It will help us to bring our plans into balance with our expected income and provide an incentive for saving money. It makes no difference if we change our plans a hundred times before we actually retire. The planning will have been fun. It will have helped

This retired telephone man's talent not only satisfies a creative urge for him, but helps others to an objective viewpoint before they are ready to retire

us to adjust our point of view, enabling us to look forward to our new status with keen anticipation rather than dread.

Enjoy Living

If you haven't enjoyed life and living before retirement, the act of retirement will not give you this enjoyment. It has been truly said that this world is not a happiness factory. One who is content merely to stay alive and sees no point in trying to do anything with his life, either to make it better or to make his surroundings a better, happier place, will be deprived of much joy and satisfaction. He will always be piling bricks, never building a cathedral. But the man or woman who lives to be able to say at the end of life, "I have fought the good fight and run a good race" will find the way to happiness.

It is not given to many to shout from the mountain tops. Most of us must live in the valley. Our deeds go unsung and unheralded, but those minor satisfactions which make for the enjoyment of living are not dependent upon the plaudits of the crowd, but upon the knowledge of a life well lived before God and man.

If you desire happiness, don't seek it for yourself but give it to others. You can't pull yourself up by your boot straps. You can have friends, and all they mean, only when you forget about yourself and become a friend to others. This is not so much doing things as it is a point of view. It is the spirit which is exemplified on the three sides of the Pioneer emblem, and can be felt as a tangible thing at Pioneer gatherings, and especially at General Assembly meetings.

Keep Your Plans Within Your Physical Ability

Many people make the mistake of assuming that at 60 or 65 they will have the same energy they had at 50 or 55. They forget that at 60 or 65 they will be on the down grade as regards physical endurance. I know a retired man who at 50 decided he wanted twenty acres to farm when he retired. At 55 he reduced it to ten acres, and at 60 he came down to five. At retirement age, 65, he rented a house on a large lot and finds that it gives him all he can take care of.

My own experience is a case in point. My wife and I, at 55, held a typical telephone conference to decide what our fundamental plan for retirement should be. We wanted to travel, I wanted physical exercise for health and happiness. We wanted to be near our friends, and live in a good all-year-'round climate.

We finally settled on a place appropriately called Paradise, 175 miles from our home base at San Francisco. The elevation is about 1800 feet, which is out of the extreme heat and below the normal snow line. Between ten and fifteen thousand people, many of whom are retired, live on this heavily wooded ridge of Paradise. Everything grows, especially the weeds and poison oak, and there is plenty of cheap water.

You would think that we, of all people, who had spent years counseling with retired and about-to-retire people, would have been sensible in acquiring a place. But no—what did we do? We went hog wild and bought two acres, thickly covered with 8-foot manzanita brush. We lost sight of everything in visualizing that land converted into our dream home.

Our plan is working out, but we would have had fewer problems mentally, physically, and financially if we had given more serious consideration to our physical limitations. If one is to build a retirement home, it is best to complete the home before retirement and thus avoid getting in beyond one's depth, unless, of course, there is plenty of money!

Make Your Plans Fit Your Income

Regardless of how well you plan, it will probably cost you more to live after retirement than you think. It is like planning a vacation. You estimate very carefully what it will cost, then add 50 per cent, and if you are lucky you don't have to wire home for more money. Most of us in our plan for retirement figure pretty close on the money we will have

Pioneers of both sexes and various ages are shown completing a course in furniture upholstery which was sponsored by a Pioneer Chapter available, giving consideration to living cost (and who can estimate that correctly today?), medical and hospital insurance, trips, etc., but we don't leave much margin for emergencies.

We are then faced with two alternatives, either cutting out some of the things we planned to do, or supplementing our income.

There is another angle to making your plans fit your income. Do your plans permit you to continue your present standard of living? Throughout our working lives we have gradually raised our standard of living in accordance with increased earnings. At retirement most of us face a reduced income.

This problem presents probably the greatest single difficulty during the adjustment period. It is very easy to raise our standard of living but very difficult to reduce it and stay happy.

Too often in our planning we deduct all the things we won't need to do after retirement, forgetting how much a part of our lives some of those things have become. Serious thought as to how you can most nearly continue your present standard of living will go a long way toward easing the adjustment period. Just to get the feel of things, some people try the plan of living, during their last year of employment, on the same amount of money they expect to have available after retirement.

Have a Hobby

Hobbies are important. Pioneers for years, through counseling, hobby shows, and hobby clubs, have emphasized the desirability of every Pioneer's having one or more hobbies at retirement. Sometimes, however, the implication is that if you have a hobby all your troubles are at an end. It just isn't so. However, when hobbies are fitted into a balanced program of living, they are extremely important in helping to maintain a continuing interest in life; they satisfy that creative urge which seems to increase as people get older.

Hobbies are important for another reason. They add interest and zest to life and help us to have an objective point of view before we retire. All of us have latent talents not utilized on our job, and if through laziness or other causes our sole interest in life is our job, these latent talents are apt to shrivel and die. Then, when we feel the need of other interests at retirement, we have a hard time finding anything we can or want to do. It is not important that the same hobbies, selected early in life, be continued, but if one has formed the habit of utilizing latent talents it is no problem to change to other, perhaps more suitable, hobbies at retirement.

Have an Objective

Plan towards something. Is it a house in the country, a farm, another job, travel, fishing, hunting, gardening, that you will want after retirement? Whatever it is, start pointing that way some years beforehand. We purchased our place five years before retirement; had a garage with a living room built for week-end use; planted a family fruit and nut orchard; planned the gardens and started drawing plans for the house. Needless to say, we changed the plans every few months, but when we retired we were pretty well set.

We had a lot of fun developing the place and making plans and if at retirement health or other causes had made us abandon them, it would still have been well worth while. We would have had no trouble shifting to something else. Our plan is probably more than we should have undertaken, but it is better to be too ambitious than to drift along without knowing where you are going.

Stay Where Your Roots Are Down

THIS IS a general rule. Many people have found happiness by moving away from their home surroundings, but they are the exceptions which prove the rule. Surveys of the retirement situation seem to show quite conclusively that for the most part those who stay where their roots are down have the happiest, best balanced life.

The desire to go and live where the sun always shines causes many people to overlook the values they are giving up. New friends and new activities never replace the old, familiar associations. You never realize how lonely you can be with strangers all around you until you have moved away from your old surroundings.

Each Must Decide

I SHOULD like to say that in writing this article it has not been my intention to try to suggest a panacea for all individual retirement problems. Individuals and their needs are different; each must decide for himself what he seeks in life and how he can best attain it.

Here's happy retirement planning to you!

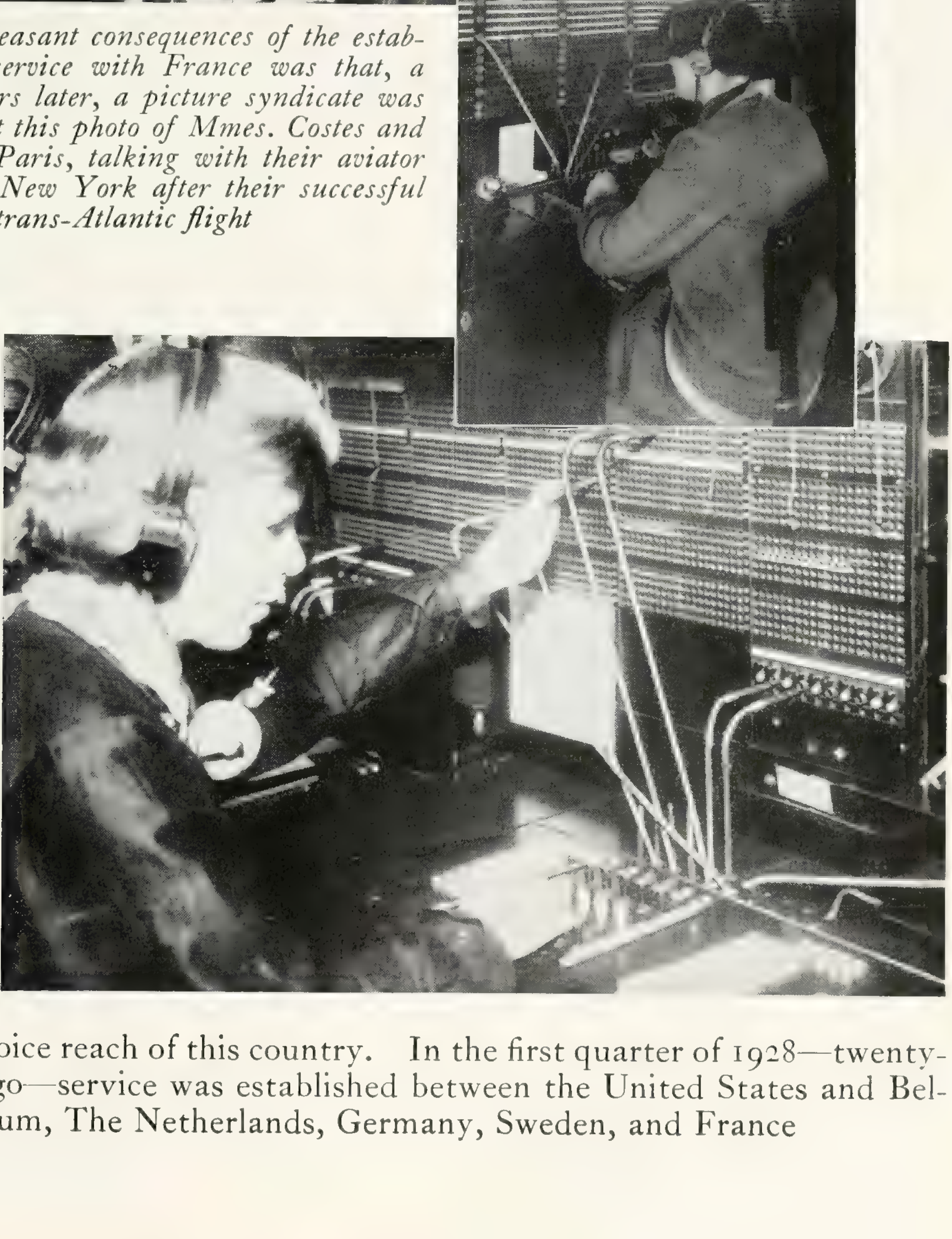
25 Years Ago

Formal opening of service to another country was a momentous occasion. A. T. & T. President Walter S. Gifford, in the presence of many company officials, greets the French Minister of Commerce and Industry in Paris on March 28

On the European side: On January 20 the Netherlands Minister of Foreign Affairs (right) carried on his end of the initial overseas conversation in Amsterdam, in the presence of the Director-General of the Service (left) and two representatives of the American Legation

Overseas telephone service had been successfully established on a commercial basis in 1927, and its extension to foreign countries proceeded rapidly in the years thereafter, until today more than 96 per cent of the world's telephones

One of the pleasant consequences of the establishment of service with France was that, a couple of years later, a picture syndicate was able to import this photo of Mmes. Costes and Bellonte, in Paris, talking with their aviator husbands in New York after their successful trans-Atlantic flight



Overseas switchboards at The Hague (center) and Berlin (bottom) looked not very different from ours 25 years ago

are within voice reach of this country. In the first quarter of 1928—twenty-five years ago—service was established between the United States and Belgium, The Netherlands, Germany, Sweden, and France

Mrs. Helene C. Bateman

Stuart Shaw

Who's Who & What's What

(*Continued from page 199*)

MRS. HELENE C. BATEMAN became a member of the original Rate Section at A. T. & T. in 1917, and since 1945 she has been head of the Exchange Rate Group. The men and women whose activities she directs assist the Associated Companies in matters concerning their exchange rate schedules, service offerings, and rate treatment for metropolitan areas. She has probably helped more people, both at Headquarters and in the field, in better understanding the theory and practice of rate making than any other one person in the System. She is the principal author of "Notes on Fundamental Principles Underlying Rates for Exchange Telephone Service"—the "Orange Book"— of which over 2000 copies have been distributed among the Associated Companies. Many of those fundamental principles are reflected in her contribution to this issue.

SEVERAL YEARS of newspaper experience in Denver preceded STUART SHAW's employment in the Public Relations Department of the Mountain States Telephone and Telegraph Company in 1928. Two years later he was appointed editor of the *Monitor,* the Company's monthly publication, which post he left in November 1952—22 years later—to become assistant personnel director in the Personnel Relations Department. During his period as editor he traveled widely in the Company's border-to-border territory, and he also gained much recognition for the professional quality of his amateur photography. To this MAGAZINE for February 1942 Mr. Shaw contributed "Across the Roof of the Continent," an article describing the construction of a new telephone line over Loveland Pass at a height of 12,000 feet, in the Rockies.

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C. EARL SCHOOLEY

Communications for Right-of-Way Companies
RUSSEL T. KING

". . . Subject to 25% Tax." • DONALD A. DOBBIE

Learning How to Do It Through Plant Training
WALTER H. FLINN

The World's Top Countries—Telephone-Wise
ELIZABETH WRENSHALL

"Telezonia" and the 3 Rs • LEROY A. BORN and
STUART D. HARTER

rican Telephone & Telegraph Company · New York

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A Medium of Suggestion & A Record of Progress

JUDSON S. BRADLEY, *Editor. Published four times a year for the supervisory forces of the
Bell System by the Public Relations Department of the*
AMERICAN TELEPHONE AND TELEGRAPH CO., *195 Broadway, New York 7, N. Y.*
CLEO F. CRAIG, *President;* S. WHITNEY LANDON, *Sec.;* ALEXANDER L. STOTT, *Treas.*

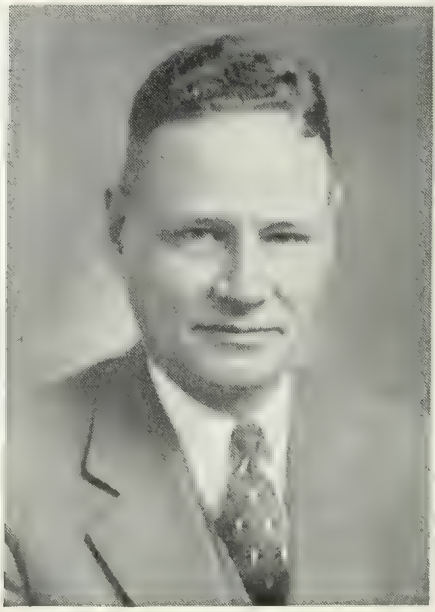
Who's Who & What's What *in This Issue*

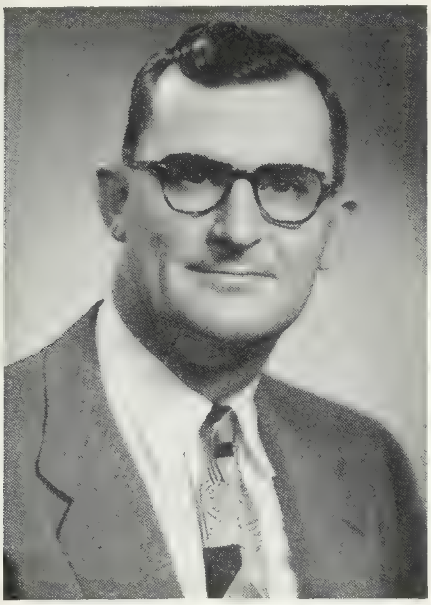
C. Earl Schooley's first telephone job was with the Bolivar (Mo.) Telephone Company, where he was a combination of night operator, lineman, installer, and troubleshooter. In 1927 he joined the Long Lines Department in St. Louis as a student, and two years later became a technical employee in the division office there. A transfer to Kansas City and a return to St. Louis preceded his assignment to the Engineering Department in New York. Here he worked on carrier systems, and in 1944 was appointed coaxial cable carrier engineer and in 1946 was appointed carrier and electrical coördination engineer. He went to Washington, D. C., in 1948, as division plant engineer, and returned to New York after a year and a half as facilities engineer. He became engineer of transmission in February 1950, and at the end of that year was transferred to the Commercial Department of Long Lines to assume the new post of commercial development engineer. His next move was to the Engineering Division of A. T. & T. Company's Department of Operation and Engineering, as toll line dialing engineer, in April 1951. He became plant extension engineer in August of that year, and since early 1952 he has been System planning engineer. It is in this capacity that he serves as Chairman of the Headquarters Long Range Planning Committee. With Richard D. Campbell, he contributed "Spanning the Continent by Radio Relay" to this Magazine for Winter 1950–51.

Since last September, Russel T. King has been Right-of-Way sales engineer, in charge of the group concerned in these activities in the Commercial Division of the O. & E. Department of the A. T. & T. Co. Mr. King started his telephone career in the commercial department of the Western Area of Bell of Pennsylvania in 1929. After holding positions in the sales organization, he was appointed assistant sales manager—directory in 1940. Mr. King came to A. T. & T. in 1943 in O. & E.

C. Earl Schooley

Russel T. King


Donald A. Dobbie



Walter H. Flinn

Elizabeth Wrenshall

Commercial as a member of the trade mark service group. He has held assignments in the new and special services, radio sales, and Right-of-Way groups.

MORE THAN two years of Naval service in World War II interrupted a career in Accounting and Treasury work which began for DONALD A. DOBBIE in 1927 with the New York Telephone Company. Soon after returning to that Company's General Accounting staff in 1946, he transferred to the Methods Division of the A. T. & T. Company's Comptroller's Department. Four years later he moved to the Earnings Division of the Treasury Department, and the following year he moved back to the Comptroller's Department. Here, in the tax section, he is in charge of the group responsible for tax research and analysis.

WHEN WALTER H. FLINN wrote the article on Plant training schools which he contributes to this issue, he held the position of plant organization and training engineer in the Plant Division of A. T. & T.'s O. & E. Department. But since last March 1, he has been employee information manager in the Public Relations Department of the Illinois Bell Telephone Company in Chicago. This is a return to familiar territory, for Mr. Flinn's telephone career began with that Company in 1928 as a central office dial switchman. Promotions in the Plant Department brought him through district plant superintendent and division plant supervisor to division plant superintendent by 1950 —with a year as general personnel supervisor. It was the first of last year that he came east to the A. T. & T. post which he has now relinquished.

MUCH OF THE information received from foreign telephone administrations in connection with the A. T. & T. bulletin "Telephone Statistics of the World" is written in languages other than English, and ELIZABETH WRENSHALL finds her facility with foreign languages useful in gathering and compiling the data which she uses in her daily work in the Chief Statistician's Division of the Comptroller's Department. After making translations for the censorship authorities during World War II, Miss Wrenshall joined the A. T. & T. Company in 1945. This is her fourth contribution to this MAGAZINE, her most recent previous one being "How the Telephones of the World Are Distributed," in the issue for Spring 1952.

(*Continued on page 67*)

A Modern Telephone Structure

Efficient location, size, type, and provision for enlargement were among the important long-range considerations involved in the erection of this headquarters building of the New England Telephone and Telegraph Company in Boston. See the article beginning on the opposite page

A Broad Objective of the Bell System Is to Enable Any Customer to Dial Calls across the Continent as Easily As He now Dials a Neighbor across the Street

Long-Range Planning: The Present's Guiding Star

C. Earl Schooley

In 1910, when there were only 376,000 telephones in New York City, the late John J. Carty, then Chief Engineer of the A. T. & T. Company, predicted that twenty years later there would be over two million. When the year 1930 rolled around, the actual number of telephones turned out to be 1,761,000—short of the forecast made twenty years before by about 18 per cent but, nevertheless, a remarkably close estimate for a period so far ahead and in a relatively new business!

What useful purpose did such a prediction have? What good does it do to forecast for such a long period ahead? Perhaps some things Mr. Carty said at the time he made this prediction will give answers to these questions.

He pointed out that in order to care properly for the communications services the public needed and would want, fundamental long-range plans by the telephone companies were a necessity. The long-range plans would be based upon all the factors that it would be possible to obtain, and the final result would be something in which each telephone company could express its confidence by using it as a guide or goal in the necessary construction each year.

Mr. Carty said the plans would represent the best judgment of qualified telephone people of what would be required ahead during a period of perhaps twenty years. He was careful to point out that no one can forecast with precision the requirements for so long a period ahead. But the telephone companies by 1910 had been working many years with fundamental long-range plans, and they knew the plans formed a trustworthy guide—provided they were kept broad. The plans would be continuously under review and modified from time to time as new develop-

When this picture of lower Broadway, New York, was taken, in the '80s, no one could then foresee the advances and revolutionary changes in communications which would occur. Nor can any one now predict what the future will bring. But flexible, intelligently coördinated long-range plans will take change into consideration in looking forward to the provision of efficient and economical nation-wide communication service

ments or changed conditions were introduced.

These thoughts of Chief Engineer J. J. Carty have been expressed in many different ways by many telephone people since the telephone was invented. In January 1953, the Directors of the A. T. & T. Company sent a message to the share owners of the company which contained this paragraph:

> "Finally, it seems to us that it is always our duty to act for the long run. Sound financing, good earnings, reasonable and regular dividends—these are all long-term projects. So is our continual research to find better means for giving better service. So is the building of the human organization and character on which good service depends. So is the training of leaders. In all our undertakings, the long view is essential."

Can there be any doubt that long-range planning is a prime requirement of the successful operation of a long-range business?

Present Importance of Long-Range Planning

THERE probably was never a time in the history of the telephone industry when long-range planning was so important or so generally needed as today.* This is true because of the large growth being experienced in both exchange and toll service and the many changes taking place in the art of communication. The increasing complexity of the communications system will in time make it difficult to maintain satisfactory service if today's methods of establishing connections between telephone customers continue to be used.

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* See "The Telephone Looks to the Future," by George L. Best, MAGAZINE, Spring 1952; and "Communication Sets Its Sights Ahead," by Harold S. Osborne, MAGAZINE, Summer 1952.

With the recent remarkable developments in electronics, opportunities to improve telephone service are perhaps greater now than they have ever been. Each new development in the technical field makes it possible to make telephone service still more valuable. When nation-wide or continent-wide dialing (since Canada is included in the plan) becomes effective, service should be faster and mechanization should permit making more efficient use of intercity circuits. If *the objective of one integrated traffic system* is to be realized, it is evident that a considerable amount of thinking and planning must be done to establish the future goals as clearly as possible.

Many business organizations have found out the value and necessity of planning for the future. Certainly every organization that has stayed in business over the years can say—and rightly—that it has planned for the future. In many cases, planning ahead has meant planning only for the next few years. For the telephone companies, planning for the next few years is just a matter of using the best tools available to get a job done. For the longer range,

New and old: a tower of the Bell System's transcontinental radio relay route dwarfs poles of an open-wire toll line. These and other means of transmission all have their places in the System's grand design of enabling people to talk with one another—no matter where

A broad objective of the Bell System is to move steadily toward an ultimate goal which will enable any customer to dial his calls across the continent as easily as he now dials his neighbor across the street. Today, 80 percent of the local service in the Bell System is on a dial basis, and it is anticipated that within ten years the remainder of this job will be virtually completed. Meanwhile, enough long distance circuits have become dial-operated to permit operators to complete more than 40 percent of the calls by dialing directly to the called telephones in distant cities. Some day the local and long distance systems will become one integrated system.

plans will determine the job there is to do and give an indication of new tools that must be developed and made available to do it. Long-range plans are subject to continuous change as new forecasts of the conditions of the future reveal the need.

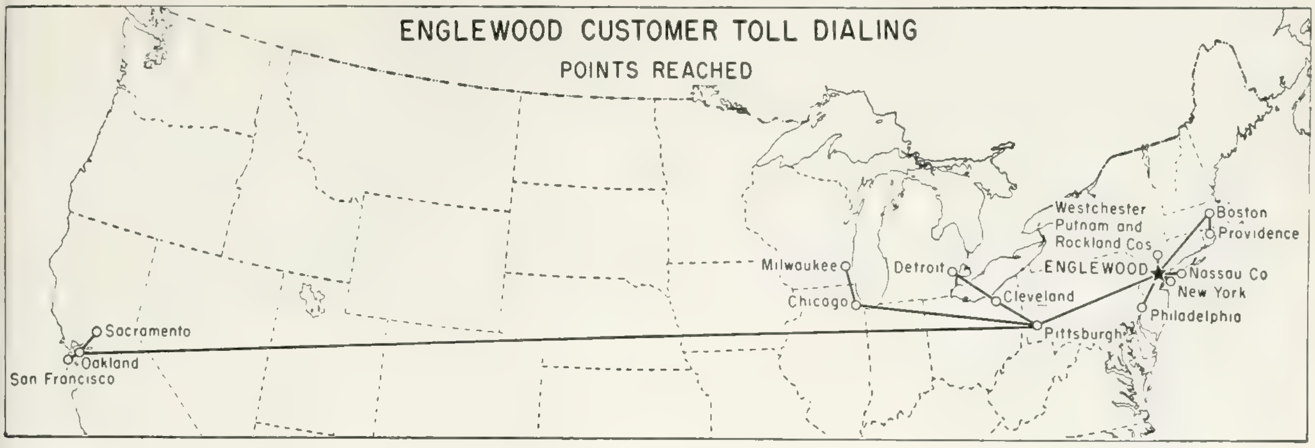
The telephone companies have for many years periodically reviewed their accomplishments and forecast what the period ahead may bring. All planning is based on forecasts, and forecasts may be likened to highway signs that tell industry where it is going and about how far. The future cannot be predicted with accuracy; but telephone people with a sound telephone background and experience can make estimates that are, within broad limits, sufficiently accurate for planning purposes. In long-range planning, a forecast of the exact date when a situation will be reached may not be too important; for, once a situation has been foreseen, it can be met when it does occur.

Naturally, as predictions of the future are extended beyond one or two years, the plans based on these speculations become somewhat tentative. Forecasts of trends in general business conditions, decentralization of industry, movement from cities to rural areas, population growth, the number of telephones in service, and the number of long distance calls to be made are in the realm of crystal-ball-gazing when directed fifteen or twenty years ahead.

Long-range plans are based on predictions of the future, and are therefore too broad in scope and look too far ahead to be supported by a detailed program of construction. There is no sharp dividing line between current plans and long-range plans; but long-range plans do establish a goal and serve as a guide for the current projects. Unless unusual and unexpected conditions intervene, plans can be set well in advance to reach the desired goals. Planning enables current construction programs to be formulated to turn forecasts into accomplishments. Planners help decide what is to be done, when, how, and by whom.

Post-War Advances

ANTICIPATING the goal set for the future, a trial of nation-wide customer dialing was started at Englewood, New Jersey, late in 1951. Newly developed central office switching and accounting apparatus made it possible for the telephone subscribers in Englewood to dial directly to about 11,000,000 telephones in thirteen metropolitan areas. Calls to Boston,



Customers in Englewood, N. J., are able to dial directly to the cities and entire metropolitan areas shown above

Pittsburgh, San Francisco, Milwaukee and other cities are now being dialed by Englewood customers on a regular day-to-day basis.

The results of this trial have been very encouraging, and the services are being continued permanently. Englewood customers have no difficulty in dialing the proper codes to reach the distant points. Nearly all the calls which can be dialed are being dialed. While it may be some years before this service is made generally available, there will be other Englewoods as conditions permit. The Englewood test has pointed the way for expanding this service. Setting up and carrying out this trial shows that extensive coördination is required to carry out the long-range plans. The far-flung aspects of the Bell System make it essential that methods of handling the calls be standard and that anything planned for one city be known and reflected in dialing plans in all other cities. Promised developments of the Bell Laboratories, not yet complete, are now being incorporated into the long-range plans of the telephone companies to permit other customers to dial their own calls.

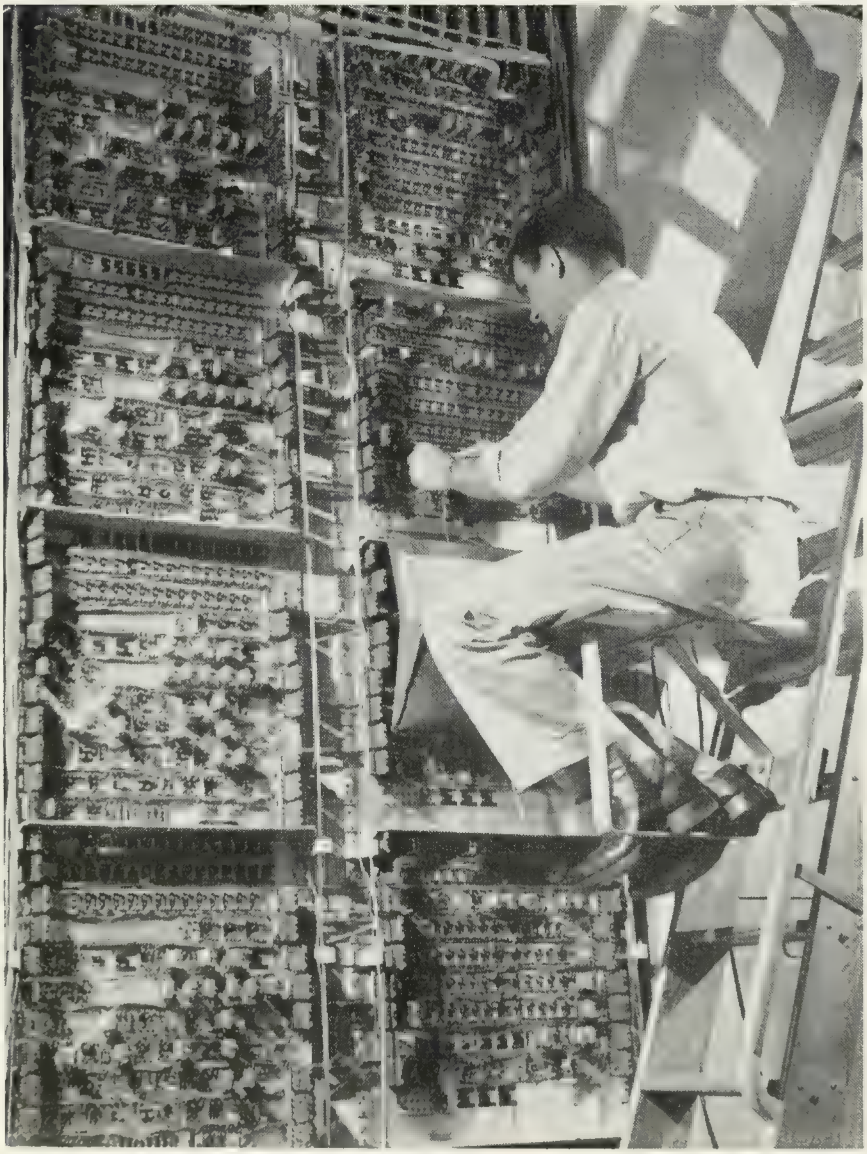
Another step toward the goal of nation-wide dialing established as a result of long-range plans is now getting under way in Washington, D.C., where the first system of centralized automatic message accounting is being

A simple assumption used as a basis for long-range forecasts is that the country will continue to grow and that improvements in ways of living and methods of conducting business will be made. The telephone business in the United States can be expected to grow with the country and expand in scope. The telephone industry should not lack potential customers. Every day there are new needs for telephone communication. With a longer life span for humans and an expanding population, more homes will be kept intact—and more homes have always meant more telephones. More industries, more businesses to serve this ever expanding population, will meet the wants rising from a higher standard of living and bring forth new and complex requirements for every-day communications.

installed for service in the Fall of 1953. Washington customers, for the most part, and those in suburban Virginia and Maryland will then be able to dial each other directly and also make their own calls to Baltimore. Eventually, of course, they will be able to dial their own calls throughout the nation.

At present, all calls of this type, of which there are thousands daily, are handled on an individual basis from many different switchboards in the Washington area. It has become increasingly difficult to maintain service economically over this large area by handling the calls on the present basis. When the centralized automatic accounting equipment is available, next fall, customers will dial the calls they want and accounting data for each call will flow automatically into the new equipment while the dialed call speeds on directly to the called telephone. Pending the development of automatic means for identifying each calling telephone, an operator will have to obtain that information from the customer and route it into the centralized equipment—a matter of only a few seconds. The equipment to do this Washington job is the result of a great deal of planning ahead about this type of problem.

These are just two of the steps being taken toward the broad objective. Others are being suggested for inclusion in current construction programs by long-range planning committees in action in the telephone companies. These committees serve to coördinate the work necessary to forecast and plan for the future. Traffic, plant, commercial, engineering, and accounting representatives usually make up the committee membership. In the Headquarters organization these departments are represented and, in



Customer dialing of long distance calls requires complex equipment. The long-range objective is to enable any telephone user in this country and Canada to reach any other simply by dialing the call

An example of the fundamental importance of long-range planning is found in the design and construction of buildings to house the component parts of the country's vast telephone system. The usual economical initial building period of four to six years is an important factor in keeping down capital requirements; yet even more important is the provision, in original design, of flexibility to permit continuing expansion for many years ahead. It is essential to give weight to many factors in selecting the site for a telephone building, be it a little community dial office or an isolated repeater station or a multi-story metropolitan structure; but probably the most vital consideration of all are the long-range plans for future development. Size of lot to permit lateral expansion, or provision of foundations capable of bearing added stories—or both if indicated—are standard procedure. This long-range flexibility is important particularly when unknown factors may affect the accuracy of commercial predictions made for periods 20 years ahead. Growth estimates, with consequent additions and rearrangements of equipment, are made every few years, and buildings must be adaptable, with a minimum of disturbance and inconvenience, to changing requirements.

addition, Bell Laboratories and Public Relations share in the committee work. It is the duty of the Headquarters long-range planning committee to keep the company committees abreast of new developments which may affect the telephone industry in its future operations.

Other Communications

What about other communication needs? What is happening to television, radio, telegraph—and the customers who need special types of communication service?

While the broad objective of nation-wide dialing has been proposed, other kinds of communication are not being forgotten. These needs are included in the work of long-range planning.

Television networks have grown from two circuits between New York and Philadelphia at the end of the War to over 30,000 miles of circuits connecting 83 cities and 128 stations. More is yet to come. No long-range plans are complete unless television is included. This means local television distribution, theater television, private closed-circuit television, and color television—as well as expansion and growth as new stations go on the air and require network connections.

Improvements in the speed of transportation have introduced problems that require more, faster, complex communication networks. The nation's commercial air lines are today using more than 300,000 miles of communication circuits to assure that reservations are properly made, that baggage and freight are properly accounted for, and that planes fly safely and on time. Every mile of these circuits, although provided by the telephone industry, is for the exclusive use of the air lines. The needs are increasing and the mileage is growing daily.

Besides these special communications requirements, communication networks are operated by the Civil Aeronautics Administration to develop and distribute, among other things, accurate weather information for commercial and private flying. There are more than 270,000 miles of circuits dedicated to providing this type of intelligence. Altogether, 570,000 miles of communications circuits are provided by the telephone industry and make up the heart and nerves of air transportation in the United States.

Most of this has taken place within the last ten years. Commercial air lines are generally less than 25 years old. Who can tell what new type of communication need will arise in the next 25 years? Planners need not know exactly what these needs will be, but the plans for them can be based on the technical facilities now available and those expected to be available in the few years ahead. By keeping the plans flexible and fluid, changes can be made as quickly as the future communication needs seem to form a definite image.

What are some of the questions about the future that the telephone planners will try to answer?

Here are a few.

When the 'teen-agers of today become heads of their own households, how many calls will they make and how long will they talk?

When telephone customers of the

Customer dialing of long distance calls requires automatic equipment to time each call, compute the charge, and record other details necessary for billing. The details of many calls are first recorded electrically on a single tape, which is then unscrambled by this computer, transcribing the data in proper sequence on other tapes

This scene in the control tower at New York's LaGuardia Field illustrates one phase of the complex communication facilities needed for the operation of the nation's airways

future can reach any telephone in the United States and Canada by dialing, how many more calls will they make than they do now?

How many telephones will families want in their homes?

What special communication needs will individuals, business, and industry have? What new technical developments will be needed?

How big should telephone manufacturing facilities be, and how much of what kind of raw materials are going to be needed?

New developments in the communication field which affect long range plans are constantly being made available by the Bell Laboratories. The Laboratories work deals, in essence, with the technical future. Research is the birthplace of new discoveries. As new developments become a practical reality, there is an obligation to use them in the telephone business if they will further the service policy. These developments are made available to others outside the telephone business, so that all can benefit, through a liberal practice of non-exclusive patent licenses.

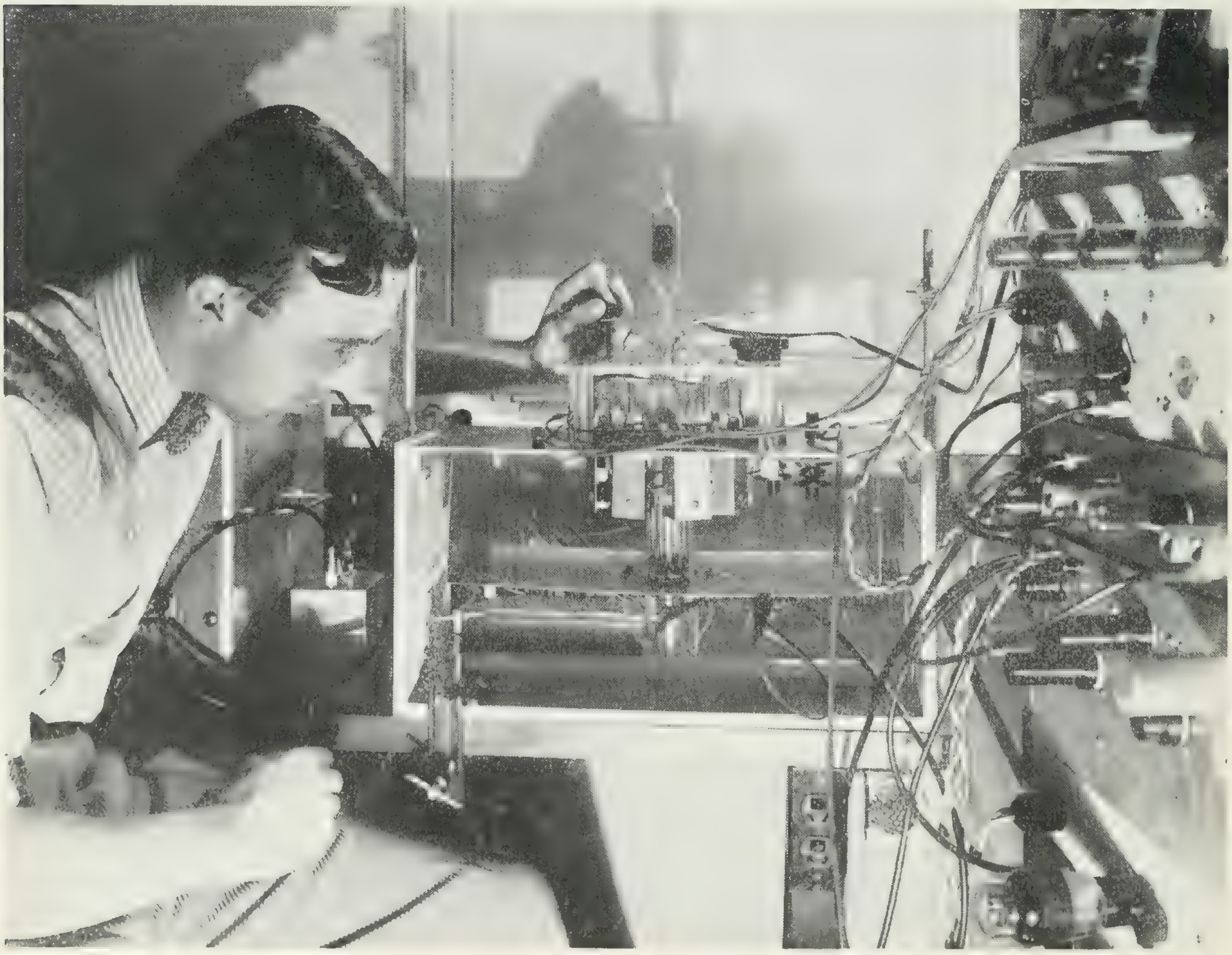
The transistor is a development of the Bell Laboratories which is being introduced into the telephone business and may eventually change the character of a good part of the telephone plant. It was invented at the Bell Laboratories in 1947. The transistor is essentially an amplifying unit which does the same work as some types of vacuum tubes. It is extremely small and requires relatively small amounts of power to operate.

Other developments of the Bell Laboratories, while not as spectacular as the transistor, are surely destined to have marked effects on the future telephone plant. Smaller, more efficient, more compact electrical and mechanical parts for telephone equipment will permit crowding more circuits into the same space, usually at less expense and with easier maintenance. Each new development seems to permit the accomplishment of more and more complex jobs.

Unexplored Opportunities

LOOKING INTO the future is one of the most fascinating jobs in any business—and particularly in the telephone business, where new and unexplored opportunities for service are continually being uncovered. Many prophecies have been made about the telephone business, yet hardly anyone today is amazed at the possibilities the future may bring, since so many past prophecies have come true.

It may be many years before the ultimate service objective will be reached. By that time, if history repeats itself, the telephone companies



New instrumentalities and techniques are constantly being developed and perfected at the Bell Telephone Laboratories to improve existing services and to provide for new services as needs arise. Shown here is an engineer at the Laboratories making adjustments on an experimental electronic "memory" tube

Close coördination and coöperative effort among the various departments, and among the telephone companies themselves, are essential to make long-range planning effective

will have newer and better objectives which will result in giving the customer more and better service. Meanwhile, since it is continent-wide in scope, all of the Bell System companies and all of the Independent telephone companies in the United States and Canada will ultimately be involved in some way. In making long-range plans, every part of the telephone business—engineering, traffic, commercial, plant, Western Electric Company and Independent manufacturers, Bell Laboratories, accounting, legal, public relations—will contribute towards setting the goal.

Long-range plans would point out the need for developing and introducing new instrumentalities. They would indicate the quantities of equipment, the types of equipment, the outside plant, the transmission systems, and the number, size, and location of buildings needed over the years to realize the goal.

But long-range planning is not all machines, electronics, and complex technical equipment. Well-trained people to carry out sound policies are essential to long-range plans and a requisite to the rendering of the best service possible. And plans must be considered to keep alive and strengthen the personal relationship between those who use the service and those who furnish it—a relationship on which so much of public understanding rests.

Once the plans are formulated, the number of people needed to operate and maintain the communication network and handle the accounting and commercial work is indicated. Out of the plans should come information which would help to determine the amount of money needed to keep the business growing as the customers' needs grow. The plans are also important to the establishment of rate structures which will guarantee that the business will continue to be an attractive place for investors.

The Needs of the Customers Will Determine

In the final analysis, everything the Bell System does must be weighed for the effect in the long run. Continued improvements in service, from the standpoint of both dependability and speed, good earnings, and fair treatment of employees are all long-range projects. Better means for giving better service, the building of a human organization, and the training of leaders are essential elements in plans for the years ahead.

As the telephone companies study and foresee the future wants and needs of their customers, the ability to fulfill those requirements with new technical developments not now available will determine the design of the telephone plant and operations for the years to come.

Planning for a Coronation

From the British *Post Office Magazine*

The Post Office is proud of the part it will play in the historic events of the month of June, when all its resources will be drawn upon in connexion with the Coronation celebrations, for in recent reigns the association of the Sovereign with the Post Office has been a particularly happy one.

The work of the telephone engineers has already begun. Special facilities have been provided for the Earl Marshal's Office and the engineers are now to plan a central switchboard around which the whole organization of the procession and ceremony will revolve. For the Coronation of King George VI a hypothetical "Coronation Telephone Exchange" was created. No doubt our experts have something similar in mind now. Not the least of their tasks will be to provide facilities for crowd control and the circuits from microphones to control points, from control points to Broadcasting House, from Broadcasting House to transmitters, so that commentaries on the procession and the ceremony may be broadcast. This time too, there will be television, with again more work for the Post Office.

Pipe-Line Networks, Electric Power Grids, and Railroad Systems Are Turning Increasingly to Facilities Provided By Bell System Companies

Communications for Right-of-Way Companies

Russel T. King

WITHIN THE MEMORY of many, mother can still be seen trimming the wicks and filling the "coal oil" lamps of yesterday, while father and the boys curried and tended the horses and filled the wood box near the stove. Yet in less than one life span, the oil lamp has become a curiosity, the horse as a work animal has been largely replaced, and father probably flips a thermostat instead of the wood-box lid. All this has happened through new and improved methods of transporting oil and gas, electric power, and other raw materials for better living.

And behind this change is the story of more and better communications.

Natural gas, today, goes to market through a vast network of steel arteries—pipes—fanning out from the Gulf Coast of Louisiana and Texas to the Pacific on the West, the head waters of the Mississippi and the Great Lakes on the North, and eastward to the Atlantic and New England. Crude oil, too, moves on schedule from well head to consumer through underground highways. Electric power for home and factory travels at nearly the speed of light from generator to user over sprawling webs of overhead wires and subsurface cables. With equal precision, the nation's railroads move people from point to point and the products of industry and the soil to their places of ultimate usefulness.

These miracles of transportation have one requirement in common: fast, dependable, 24-hour-a-day communications, not only between people but also between sensitive electronic devices. And as the utility highroads to market grow more complex, communications become increasingly important.

Utility company communications are generally of two kinds. One involves ordinary day-to-day business transactions between the public and the utility company and within the utility organization, over facilities similar to those everybody uses. The other concerns highly specialized requirements relating to the utility's internal operations. In both cases these needs can be and are being met completely by the telephone companies.

Pipe-Line Information

PICTURE a public service business operating through isolated countryside on a narrow strip of land stretching from the Rio Grande to New England. Such is one of the world's longest natural-gas pipe lines. To insure efficiency of operations along this pipe line, all activities must be carefully coordinated from a central dispatching point in Texas through a fast, dependable communications system. This system ties together some 180 gathering points at the beginning of the line, about 20 compressor ("booster") stations along the way, and nearly 100 sales stations in the northeast.

Communications play a vital part in the efficiency, safety, and scope of these vast operations. They help to keep the flow constant, clean, and adequate to meet the growing requirements of customers. Every hour on the hour, 365 days a year, the dispatchers gather numerous statistics from the field—such as suction and discharge pressures, temperature of the gas as it enters and leaves each station, atmospheric temperature, number of engines in service—which are recorded on a dispatching report. It is this dispatching report that the superintendent of gas control uses to regulate the flow of gas, balancing the "through-put" to correspond with customer demands or operational needs as they arise.

There was little need for communications in operating the nation's early pipe lines. Probably the first commercial line was laid down in 1863. It was a jointed two-inch iron pipe, two and a half miles long, that carried crude oil between the Tarr farm and the Humbolt refinery in northwestern Pennsylvania. It had a short life, for local teamsters, who were getting $3 to $5 a barrel for transporting oil in those days, violently resisted all attempts to construct pipe lines.

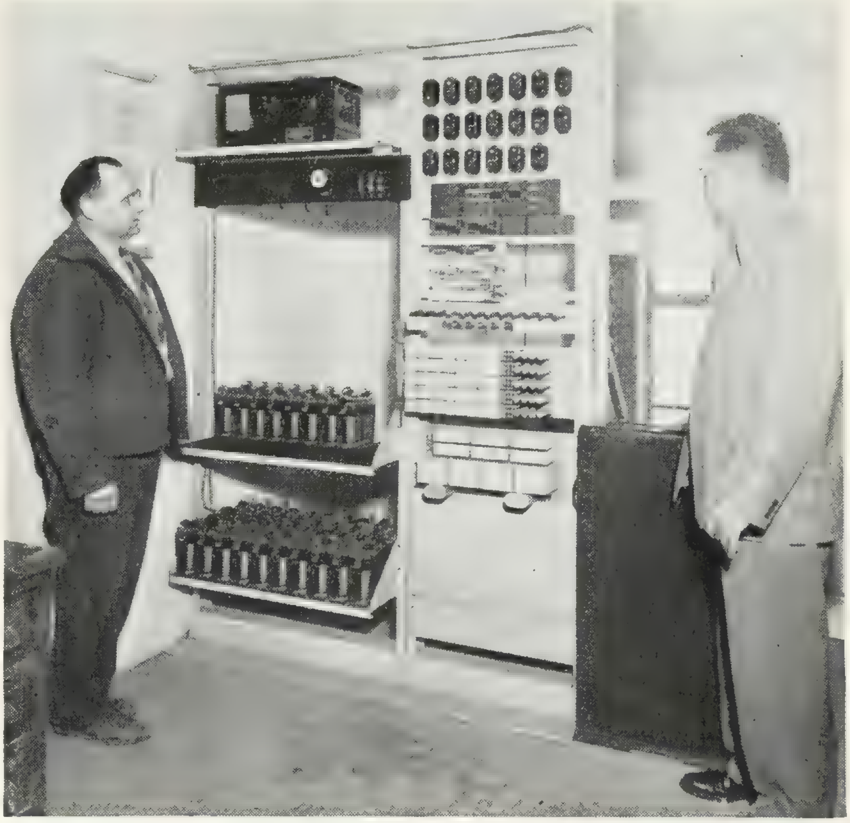
Finally, a Martin Van Sickle built in the same general locality a six-mile line of 2-inch cast-iron pipe, with three steam-driven pumps spaced at intervals along the line. Apparently half his crew laid pipe while the other half fought off teamsters. Van Sickle put 80 barrels a day through the 6-mile line at $1 a barrel—less than half the rate then prevailing by team. Today petroleum products travel as much as 1,400 miles through pipe lines at 45 cents a barrel.

Modern Communication Methods

THE EARLY attempts to transport oil and gas to market by pipe line cast a long shadow before them. As demand for oil and gas products pyramided in succeeding years, the underground transportation system kept pace. Today the network of pipe lines which carries gas, crude oil, and refinery products to homes and factories in America exceeds 533,000 miles in length, and is growing at the rate of about 15,000 miles a year.

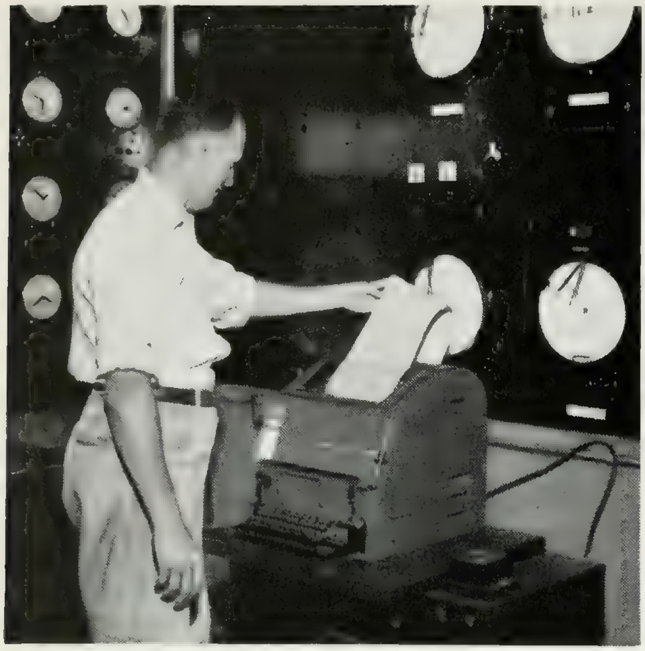
These underground lines employ enough pipe to circle the globe over twenty times, yet the chances are that even in localities where pump or compressor stations are situated, the average citizen is only vaguely aware of their significance. Yet these stations house machinery that never stops running — machinery which controls the flow and the quality of natural gas and petroleum products.

Initially, the pipe-line companies often provided their own communications system, located along their rights of way. Today, as these systems need additions and replacements, more of the pipe-line companies are turning to the commercial telephone companies for communications facilities.

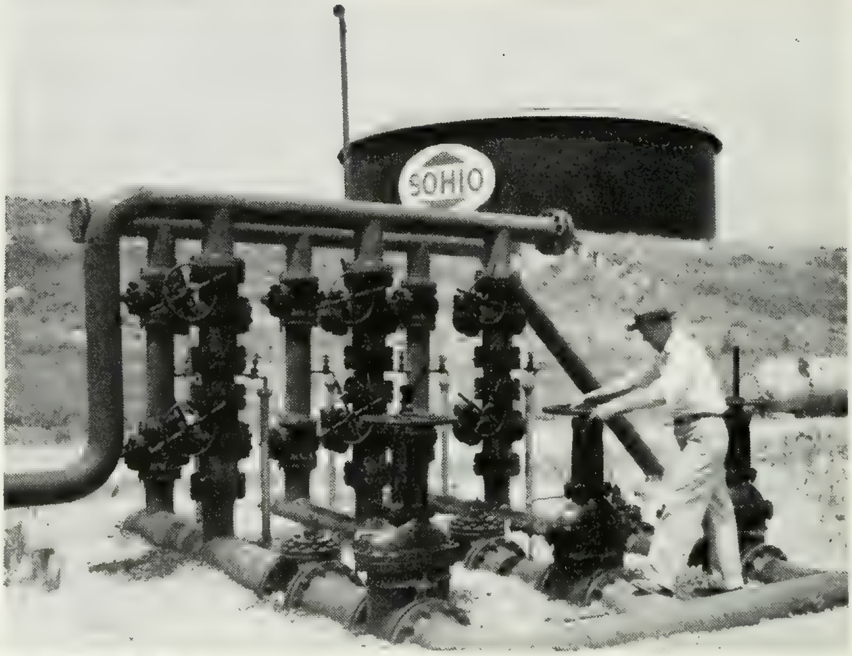


Station operators at the dam below read signals showing the position, at three unattended automatic substations, of main transmission line switches, feeder oil circuit breakers, changes in oil temperatures, operating air pressures, control voltages, and similar operating data

Special indicating equipment provided by the telephone company bring reports to the operators here



The station engineer of a pipe line receives word from the chief dispatcher to expect the flow of gasoline at a given time



He proceeds outside and makes the necessary adjustment to the valve

He reports back: "All open and ready to receive," and soon gasoline is pouring into the storage tank at the terminal

Recently, for instance, the Tide-Water Pipe Line Company, Ltd., considered the oldest long distance pipeline company in existence, had Bell System private line teletypewriter service installed for operational and administrative purposes. The new communications system replaced its privately-owned Morse telegraph system. During 1952 many pipe lines accepted recommendations from Bell System Companies for internal communication networks either in whole or in part.

Power Company Needs for Communications

THE IMPORTANCE of communications in power company operations for dispatching and control purposes is apparent when one considers that a power system must generate at each moment the exact amount of power required by the customers. Storage of electricity on a large commercial scale is impossible.

Generating plants are not generally located at the load centers. Thus power has to be distributed from various plants to where the load is. Communications are essential in coordinating this distribution. Each power company has a dispatch center, which is the nerve center of its operations. The load dispatcher forecasts load requirements of the system, arranges for power generation to meet these requirements, and insures delivery of energy to areas where it is needed. He is responsible for the maintenance of the system frequency and the over-all operation of the power system. He orders the prompt isolation of sections affected when trouble hits, and calls for the system rearrangements necessary to maintain continuity of service.

In order to discharge his responsibilities, the dispatcher must have communication facilities over which he obtains the information he needs to run his job. He must have means of communicating with his headquarters administrative office, with other load dispatchers in his own area and in interconnected power companies, and with his main generating plants and substations. He must have various control and metering circuits.

The generation of electric power and its use in the United States dates back to the late 1870s. Initially, generation was limited in scope by the low voltages of the d-c distribution systems. The use of electric power was confined principally to cities where one power station could serve a number of customers. The first alternating current system in America using transformers was put in service at Great Barrington, Massachusetts, in 1886, to serve about twenty customers—including the local telephone office.

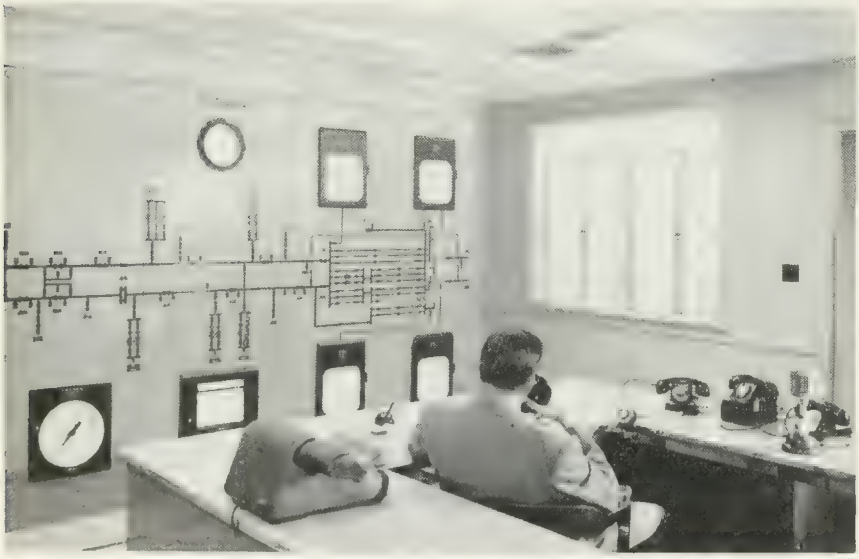
SINCE early operations were limited, communications facilities were provided by wires added to the power companies' pole lines along their rights of way. As the power companies expanded, and improved techniques made the transmission of electric energy over longer distances practicable, there was an increasing need for additional communications facilities. In the 1920s, carrier communications systems were developed which made it possible to transmit communications over the same wires used to carry power. This new medium helped to meet expanding communications requirements of the power companies for several years, but it had limitations. The frequency range soon became saturated in many areas and the addition of new "drops" on the carrier circuits made attenuation a serious problem, particularly in providing relatively long-haul communications.

Today, with the constant increase in power usage, and improvements in the transmission of electric energy, larger and more economically operated power plants are being located nearer to sources of fuel supply. Power companies are interconnecting to form power pools for the exchange of power, and the complexity of communications requirements has multiplied.

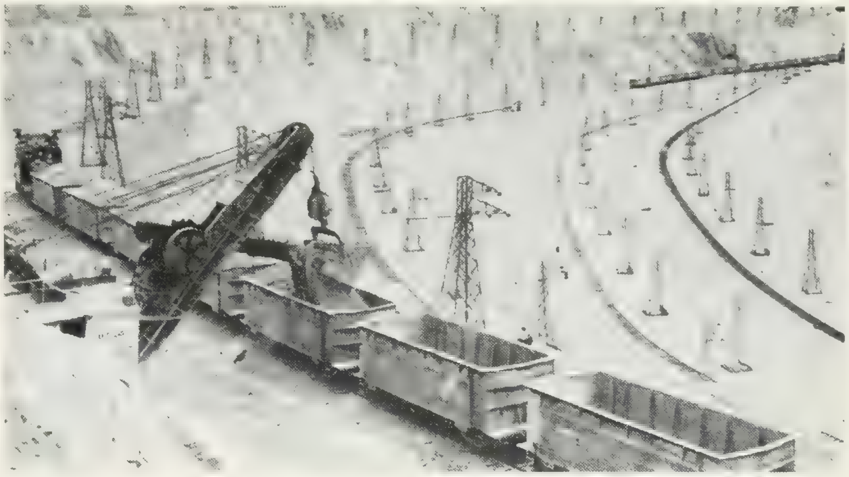
Such interconnections, properly controlled by high quality, extensive, and often complex communications systems, permit pooling of reserve capacities and provide a maximum degree of reliability of power to individual plants or areas. By coördination, deficient supplies of power in one area can be supplemented by surplus supplies from other power plants in the interconnected network. The peak loads in different areas usually do not occur at the same time. This is principally due to differences in time zones and differences in the load demand because of load and occupational diversity in various areas.

Wilmington, Delaware, and Atlantic City, New Jersey, exemplify the benefits gained through the flexibility of power pools. During the day, generating stations produce huge quantities of power for Wilmington industries. At night, when these industries shut down, the output of power is available to light up Atlantic City's gay white way, its hotels, boardwalk, and piers.

In many sections of the country today, interconnection of power companies is an accomplished fact, and in some areas plans are being developed to interconnect such systems with one or more similar interconnected systems. Multi-company enterprises have also been created, such as Electric Energy, Incorporated, in Illinois, and the Ohio Valley Electric Corporation, for the sole purpose of supplying bulk power at a given location—more power than one company could supply by itself. These power pro-



The district superintendent of a large pipe line watches the indicators on a control panel which report valve and pressure conditions at a remotely controlled measuring station nearly 60 miles distant, while he talks to gas control headquarters 1500 miles away. Through telephone facilities he can dial into five similar stations to obtain like information or to open and close valves ducing organizations are supported by a spider web of channels for voice and written communications, telemetering (transfer of measurements from a remote location), and protective relaying (arrangements to protect the power system during occurrence of trouble conditions). Channels are also required for supervisory control (supervision and control from a central point of a number of functions at one or more remote locations) and frequency and load control (automatic signals transmitted over a communications channel to regulate power generation).


The engine of this train is one of 18 in an open-pit copper mine operation whose movements are directed over Bell System private mobile telephone equipment

The 1952 construction expenditures of investor-owned electric power companies throughout the United States amounted to 2½ billion dollars, and the industry's post-war outlays for new plants and equipment now total approximately 13 billions. The construction budgets of the companies for 1953 aggregate almost three billion dollars, and by the year's end nearly 50,000,000 customers will be using these services. In view of this rapid growth and the increased usage by all customers, the power industry has estimated that it will require a ten-fold increase in communications facilities in the next five to ten years. The large amounts of capital required for such expansion and the increasing complexities of the communications systems required have led more and more of the power companies to decide against providing their own communications facilities. Furthermore, power-line carrier communication systems have limitations as to capacity and freedom from interference which tend to restrict their general expansion. The telephone companies, realizing the needs of these customers, are working closely with them to provide the best communications facilities obtainable.

As an example, one of the Bell companies recently executed an agreement with a large hydro-electric power system to take over its entire private communications network, and to provide for all future requirements. The customer's telephone plant is a substantial telephone system, and will be assimilated over a period of five years. It includes some 10,000 stations and over 15,000 miles of physical telephone circuits.

Internal Communications for Railroads

UNLIKE THE pipe-line and power companies, the railroads almost from their earliest beginnings had a right-of-way communications requirement.

The expansion of the railroads was coincident with the invention and development of telegraph service, and each complemented the other. The railroads required wire communication in order to operate effectively, and the telegraph industry required lines between cities and towns. As the railroads were being built, telegraph lines were strung parallel to their rights of way. In return for the use of the right of way, wire facilities were allocated to the railroads for their exclusive use.

In time, the railroads paralleled the telegraph facilities with telephone channels, building up complex communications systems which today represent a total investment of hundreds of millions of dollars.

With the increasing costs of operations and the need for large amounts of capital to introduce more efficient and economical equipment and methods, railroads are taking a new look at their communications requirements. Mobile radio systems are being used to facilitate switching in yard operations, train-to-train, end-to-end of train, and train-to-wayside communications. In several cases, industrial television is under trial for checking freight car numbers and the condition of cars and equipment on moving trains. The telephone companies have long coöperated with the railroads in working out solutions to their communications problems, and are prepared generally to offer whatever communications facilities they need.

This engineer of a diesel locomotive is receiving instructions from the yardmaster over mobile radio telephone facilities leased from the telephone company

Opportunity and Challenge

SINCE THE public interest is so heavily at stake, the communications circuits of pipe lines, power companies, and railroads must provide dependability and continuity of service. For example, if a communication circuit is interrupted even for a short period, the flow of gas or fuel oil to a community through a pipe line might be curtailed, or the flow of electric power to a community significantly altered, or the continuity of train operations affected.

The telephone companies recognize that utilities need high-quality reliable communications. They are using all their "know-how" in special preventive maintenance and are employing new and better circuits and devices as they become available. They are insuring a high continuity of service by careful planning of alternative routings in the event of interruptions. Telephone company plant and commercial people frequently visit critical points of operation to observe the condition and operations of telephone facilities. They are seeking to learn at first hand the customer's needs, and the reaction of field people to the service being furnished.

Pipe lines, power companies, and railroads have unusual communications requirements because of their long rights of way through territory which is sometimes remote and relatively inaccessible, where telephone companies may not be operating. In earlier days, frequently the only practicable way of meeting these requirements was for the so-called right-of-way companies to provide their own communications along their rights of way—interconnecting with telephone company facilities, under operating agreements, as required.

Over the years, however, telephone company facilities have expanded tremendously—particularly since World War II. The Bell System now has more than ten times the toll circuit miles in its plant that it had in 1925, and about four times that of 1940—or over 30,000,000 miles. Whereas in 1925 over one-half of the plant was in open wire, today open wire comprises less than one-fifth of the mileage. Of the circuit miles in cable sheath, about 70 per cent is underground. Not only is the network more extensive but it is more reliable. The telephone companies are in far better position today to supply the services needed by utilities, and desire to do so to the fullest extent practicable.

Using the Best "Tools"

To provide better communications, the telephone companies are endeavoring to meet individual requirements with the "tools" that will furnish the best and most dependable service at reasonable cost to the customer. One of these many "tools" is radio, a relative newcomer.

The dispatcher of a large natural-gas pipe line company receives hourly pressure time reports from gathering, compressor, and metering stations

In the field of point-to-point radio, microwave is proving of great value in providing communications, especially over long hauls where large numbers of circuits are required.

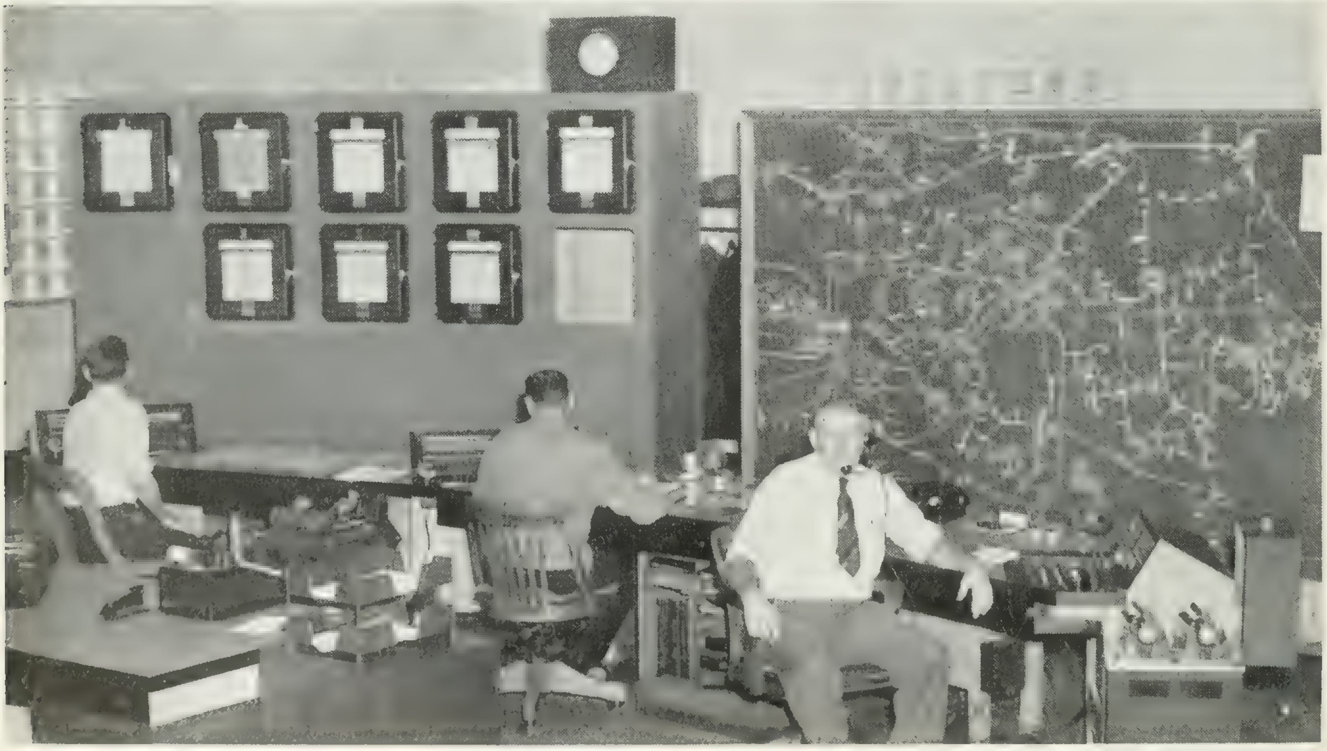
The Bell telephone companies have had extensive experience with radio relay. The Bell Laboratories have designed the systems which are being used on the trancontinental and other long routes to provide television and other communications channels. These systems are manufactured and installed by the Western Electric Company, and the Bell System Companies engineer, operate, and maintain them. By the end of 1952, the telephone companies had more than a million miles of telephone circuits over radio relay.

The Bell telephone companies also use microwave radio systems over routes where hauls are short and channel requirements are small, in cases where this appears to be the best method of furnishing the desired service, considering both reliability and cost. In addition, little brothers to the Bell System transcontinental radio relay system in the VHF band provide telephone service to a number of remote locations where only a few channels are needed. For example: two toll stations provided by VHF were used to serve a new petroleum field in Utah which an oil company was undertaking to "prove in." The area was 77 miles from the nearest wire telephone lines.

Several Bell System companies have also made radio installations paralleling open wire lines, to provide added circuits. Since radio circuits are subject to hazards quite different from those affecting wire facilities, this diversification of facilities provides added protection against service interruption.

Microwave radio is a fast-changing art, and obsolescence is a factor to be considered before selecting it as the "tool" to do a particular communications job. As an example, since the installation of the New York-Boston radio relay system in 1947—the first successful long-haul system—there have been changes in the antennae, new types of vacuum tubes have been developed, new circuit and equipment arrangements have been designed, and changes have been made in the gas pressure systems used on the wave guides. This all has happened in less than five years, and undoubtedly the years ahead will bring many new developments.

The Bell telephone companies feel that microwave can play a real part in providing communications. However, it is only one type of facility among many. The art is developing and changing rapidly and there are many cases where other types of facilities prove best suited to meet the particular communications needs.



The dispatching turret in the right foreground was especially designed by the telephone company to meet the requirements of a large power company

Bell System engineers use a balloon and a portable tower to select sites for microwave radio telephone stations for a private-line radio telephone system being installed for a major power company

The telephone companies are also extending their cable network at a very rapid rate, using both coaxial and multi-conductor types. While this radio development has been taking place, continuing progress has also been made on improved types of carrier current systems, some of which have been designed especially to provide small numbers of circuits—4 to 16 on an open wire pair and 4 to 20 on a cable quad. These systems are well adapted to meet the expanding requirements of oil, pipe line, transportation, and utility systems by providing additional capacity on wire or cable routes. Furthermore, these systems can be used for integrated wire and radio arrangements in which the carrier currents are transmitted part of the way by wire lines and part by radio without interposing carrier terminals at the junction of the wire and radio systems. This type of arrangement allows great flexibility in the selection of the type of facility for a particular situation.

Beyond the microwave and cable carrier systems, there are other things in the offing. The Bell Laboratories are conducting research work on a new system, for instance, which may provide even greater band widths than do present radio relay systems. This is an extremely-high-frequency wave guide system which may make possible the transmission through hollow pipe of a band width of several thousand megacycles over long distances. Progress in research continues to resolve problems that must be overcome before the wave guide can take its place alongside the paired cable, the coaxial cable, microwave transmission, and similar facilities.

As these new developments occur and prove economically attractive, the telephone companies incorporate them into their plant as rapidly as they become available. Telephone company customers thereby automatically benefit from improvements in the communications art.

Mobile Radio Widely Used

Mobile radio facilities have become very important to utilities, increasing the flexibility of operations both in cities and along their rights of way. In addition to the general mobile telephone service, now available to some 12,000 vehicles—including water craft, locomotives, and heavy movable equipment—the telephone companies also provide private mobile radio systems, and have 500 such systems under contract, serving nearly 7,000 mobile units—about 40 percent of which are furnished to utilities.

Provision by the telephone companies of the best "tools" includes not only the circuits used to carry the communications but also specially built instrumentalities and specially designed circuit arrangements, such as switchboards and dispatching turrets, selective signaling equipments, special circuits for remote control and metering, and similar items.

One recent example is a newly designed dispatcher's turret soon to be installed for the Bonneville Power Administration. BPA had a requirement for a dispatching turret small enough in size to be operated by one man but capable of handling 80 to 100 lines with a number of special operating features. Since such turrets might be used in other power-company situations, engineering work by a team of Pacific Telephone and Telegraph Company, American Telephone and Telegraph Company, and Bell Laboratories experts, in consultation with BPA, was rushed to completion. The Pacific Company arranged to assemble the equipments locally. Later this turret will be standardized and made available through Western Electric for other customers with similar needs.

In several cases, pipe-line and power companies are being furnished circuits and selective signaling arrangements for remote control and metering purposes. As a result, dispatchers at one location can select and read meters, start and stop pumps and motors, open and close valves, and obtain indications of switch positions at several distant points. In fact, they can do remotely just about anything human beings on the spot can do. These developments constitute further evidence of the desire of the telephone companies to help these customers.

Ringing Door Bells

Recognizing the importance of better communications, telephone company representatives made 33,000 visits during 1952 to the pipe lines, power companies, and railroads to offer them assistance in meeting their changing communications requirements. Such visits have been supported by telephone company officers and operating heads who have, through personal contacts with executives of the utilities, affirmed the desire of the telephone companies to meet their communications needs fully.

As a result of those efforts, comprehensive studies of message traffic and operational requirements are now under way with more than 100 major pipe lines, power companies, and railroads. These studies are designed to help the customer obtain the best use of exchange, toll message services, and private line facilities.

A study recently completed for one of the largest petroleum enterprises in the United States resulted in a decision by its management to sell its communications plant to the telephone companies and to "lease" facilities for all future requirements.

Why Bell Service?

The telephone companies offer a dependable and economical communications service. Rates are reasonable, and the utility "leases" only the services it needs as it needs them, tailored to its individual requirements. There is no need to invest capital in communications equipment, set up reserves for obsolescence, and provide manpower for engineering, installation, and maintenance. Furthermore, changes in the customer's operational requirements will not leave him with facilities he no longer needs—as is sometimes the case when he owns his communications plant.

One power company executive stated recently that there are many advantages offered by coördination of utility communications with the telephone companies. It avoids duplication in plant, results in saving in space requirements and in use of critical materials, improves reliability (e.g., greater number of alternative routes made possible), provides much greater flexibility, and gives undivided control of communications and greater convenience. The power company can take full advantage of Bell technical advances and its own personnel can be assigned exclusively to the company's "bread and butter" job.

Whether a utility carries oil or gas, electric power, passengers or freight, it is in the transportation business. And, for that matter, so are the telephone companies whose channels reliably transport the operating intelligence for these basic industries. Both have come a long way together since the day mother used to trim the wicks and fill the "coal oil" lamps. Together, these specialists, each in his own field of accomplishment, are helping each other to meet the challenge of greater usefulness.

Customers Now Pay Well Over $600,000,000 a Year in Excise Taxes on Telephone Service Furnished by the Bell System Companies

". . . Subject to 25% Tax"

Donald A. Dobbie

Many years ago, Benjamin Franklin wrote that "Our Constitution is in actual operation; everything appears to promise that it will last; but in this world nothing is certain but death and taxes." Happily, since that time advances in medical science have added many years to our lives. Not so happily, the increasing complexities of our world today have added many dollars to our tax bills.

Probably the most difficult task which confronts our Congress each year is the job of determining the amount of taxes which must be collected and the manner in which these taxes may be raised. While this article proposes to discuss only one particular form of taxation—the 15% and 25% Federal excise tax which telephone companies are required to collect from their customers on charges for local service and toll calls—let's first take a quick look at the size and make-up of today's Federal tax structure, to see just where these excises fit into the picture.

For 1952, the Federal Government's internal revenue collections were derived from three principal sources: corporation income and profits taxes ($22.1 billion, or 32%), individual income and employment taxes ($36 billion, or 53%) and miscellaneous internal revenue taxes ($10.4 billion, or 15%). The miscellaneous taxes, while including such items as estate and gift taxes, consisted primarily of the various excises on alcoholic beverages, tobacco, manufacturing, entertainment, transportation, communications services, and other items, and the retailers' excises on furs, jewelry, luggage, and toilet preparations.

The main premise underlying most of these taxes—corporate, individual, and miscellaneous—is relative ability to pay. Corporations having surtax net incomes of more than $25,000 pay at higher rates than smaller corporations; individuals pay at rates which are on an ascending scale in proportion to their earnings and income. Historically, most miscellaneous taxes have been levied on articles which are not strictly necessities, and the rates have been scaled so that, by and large, the higher rates apply only to so-called luxury items.

In other words, excise taxes are not levied on such fundamental day-to-day living costs as rent and housing, food, water, gas, electricity, clothing, drugs, and carfare. Rather, they are placed on such commodities and services as alcoholic beverages, tobacco, theater and cabaret admissions, furs, jewelry, gasoline, automobiles, and electric appliances. In most cases, the commodities and services subject to these excises, while contributing to our standard of living, could in time of necessity be eliminated or their use materially curtailed without impairing the health, safety, or well-being of the community. These products are not all luxuries, but most of them (particularly the ones in the high excise brackets) are definitely not essentials. To this extent, the excise taxes on these products follow the basic theory of ability to pay.

The outstanding exception to this premise is the excise tax on telephone service.

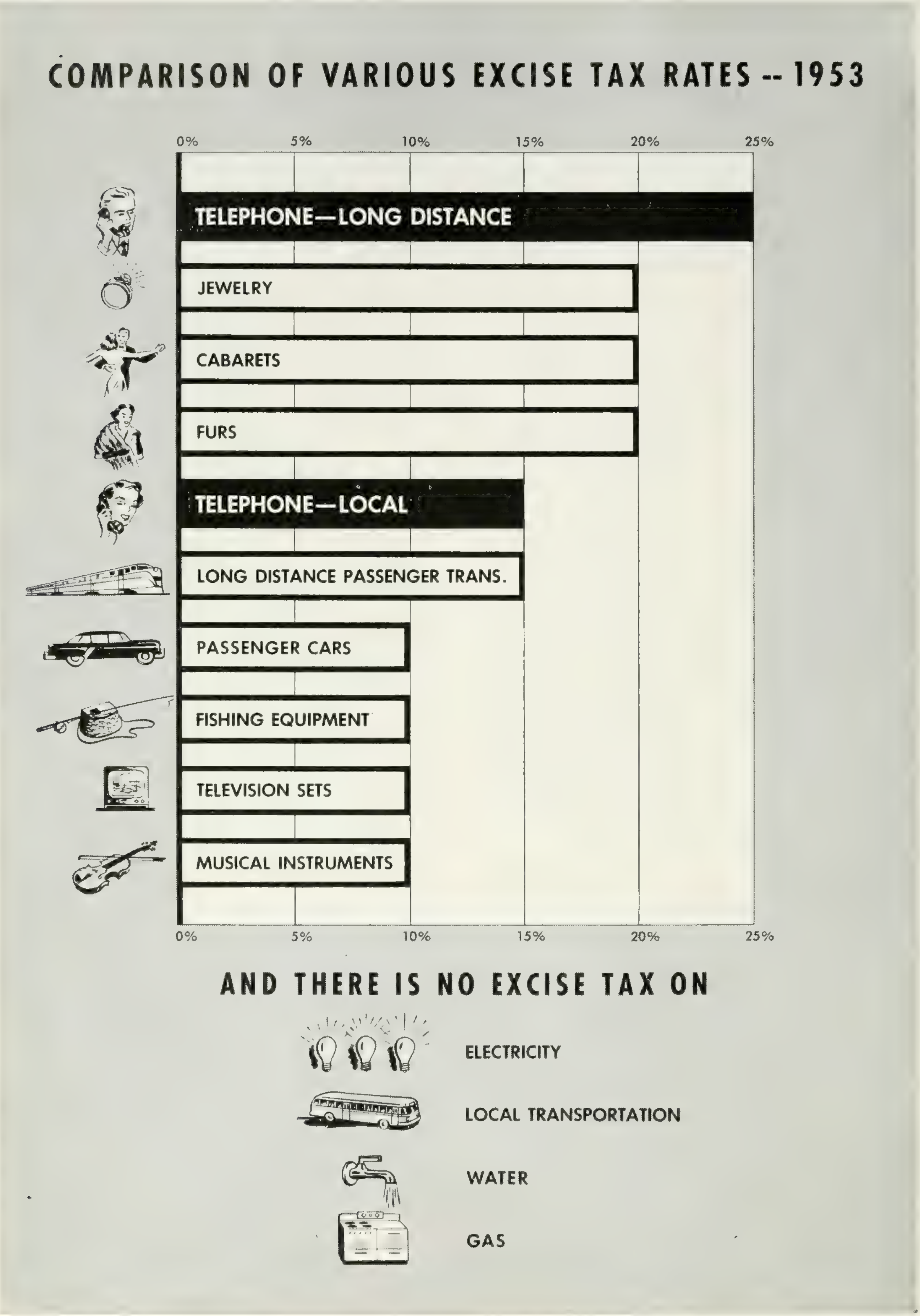
Telephone Excise Tax Highly Discriminatory

In the regulated public utility field, bills for electricity, gas, and water are not subject to Federal excise tax. Neither are charges for local and short-haul transportation, including taxicab fares and commutation tickets, although comparable local and short-haul telephone service is taxed at the high rate of 15%. The tax on long-haul transportation of persons is considerably less than the tax on long distance telephone calls—15% as compared with 25%. In the communications field the Congress found it desirable recently to reduce the excise tax rate on telegraph service—an industry which, like telephone service, is essential to national defense—from 25% to 15%.

For 1952, the operating companies of the Bell System collected and turned over to the Federal Government $615 million in excise taxes. For the same period, the companies paid on their own operations some $706 million in Federal, state, and local taxes. The tax portion of the amounts collected from telephone users, therefore, amounted to well over a billion and a quarter dollars—an average of $2.85 per telephone per month—of which 47% (the excise tax portion) entered in no way into the cost of furnishing telephone service.

The discriminatory nature of the telephone excises is even more sharply revealed when the rates are compared with those on so-called luxuries. Only alcoholic beverages and tobacco are taxed at rates higher than the 25% applying to telephone toll messages over 24 cents and to leased wires. Cabaret admissions, jewelry, furs, and cosmetics bear a smaller excise burden. The 15% on local telephone service is greater than the excises applying to television sets, passenger automobiles, musical instruments, and air-conditioning units.

Most people agree that telephone service today is a necessity, not a luxury. At the end of 1952, some 67%



COMPARISON OF VARIOUS EXCISE TAX RATES -- 1953 of all households, representing more than one hundred million people, had telephone service. Over the years the telephone has become firmly established in the peace-time economy of the nation. We depend on it in most of our normal business and social transactions, as well as in emergencies —to call the doctor, the fire department, the police. Its importance in times of national emergency is so well recognized by both the government and the public that it need not be stressed here.

The telephone excises reached their present peak with the imposition in 1944 of what were termed "war tax rates" by the Congress, and it was provided in the law that such rates were to expire six months after the end of hostilities. These rates were imposed at that time largely to discourage the use of telephone service and to conserve the then existing facilities for war-time needs. It is plain that the need to discourage the use of telephone service no longer exists. Since the end of the war the number of telephones in the United States has increased by 72%, and the Bell System average telephone plant investment has more than doubled. However, the "war tax rates" were continued by the Congress in 1947 without definite termination date.

Of Concern to Customers, Companies, and Commissions

LET'S SEE WHY we, as members of the telephone industry, should be concerned about these taxes—which, after all, are taxes levied directly on our customers, not on the telephone companies.

The cost of any product or service includes not only such expenses as labor, material, and overhead, but also any Federal, state, or local taxes levied on the companies involved in providing such products or services. In the case of telephone service, however, the customer is required to pay a large additional charge—the excise tax—which does not enter in any way into the cost of furnishing such service. This additional amount is specifically identified on our telephone bills, and yet it is difficult for the telephone user to think of his bill as being made up of two amounts, one of which represents his cost of service, the other an additional tax superimposed on the bill and turned over by the company directly to the Federal Government.

With the continually increasing demand for telephone service, we are in constant competition with other industries for the capital—money—to finance the improvement and expansion of our service. We have been forced to apply for increased rates not only to meet today's inflated costs but to provide the earnings so sorely needed to attract the necessary additional capital to the industry on fair and equitable terms. The effect of Federal income taxes on our rate structure is well known to both the companies and the state and Federal regulatory commissions: the fact that in order to obtain a dollar of earnings for our investors we must, at the present 52% tax rate, be permitted to collect $2.08 from our customers, of which $1.08 will go to the Federal Government in tax.

This 52% Federal income tax rate is certainly high, but it applies to all large industries—not just telephone companies. Where telephone service is singled out for discriminatory treatment is that the companies furnishing such service are required to collect from their customers an additional charge which increases the amount individuals must pay for that service but which has nothing to do with the cost of rendering the service. This is the reason why we in the industry should be and are concerned about the telephone excise taxes.

This problem is also of great concern to the regulatory commissions. Although the excise taxes are not directly considered in telephone rate cases, the commissions cannot help but realize that whatever charges they approve will be increased by fifteen or twenty-five per cent through the application of these taxes. At the meeting of the National Association of Railroad and Utilities Commissioners last fall at Little Rock, Arkansas, this matter was considered so vital that the convention passed a resolution stating that ". . . the present excise taxes on communication services are inimical to the maintenance of reasonably priced and non-discriminatory communication services and that, accordingly, the excise taxes on communication services should be repealed or greatly reduced."

Phone Users Not Fully Aware of These Taxes

THE FACT that the telephone user does not realize the effect that these excises have on his cost of service is borne out by a nation-wide survey of telephone customers which was made last year. Less than one in five of the people interviewed knew the excise tax rate on toll service; nearly half of them didn't know whether any excise tax at all applied to such service.

The Bell System companies have often pointed out the impact of these taxes on our customers and, as stated in the A. T. & T. Annual Report for 1952 ". . . we shall continue to present to the taxing authorities our views as to why and how this burden should be reduced." We feel an obligation to our customers to do this. It is also our responsibility to do everything we can to make our customers themselves aware that they are at the present time forced to bear this discriminatory tax load as a part of the cost of telephone service.

Index Now Available

AN INDEX to Volume XXXI (1952) of the BELL TELEPHONE MAGAZINE may be obtained without charge upon request to the Public Relations Department, American Telephone and Telegraph Company, 195 Broadway, New York 7, N. Y.

About 300 Bell System Plant Schools Complement On-the-Job Training to Help Many Thousands of Employees Acquire Or Improve Craft Skills Each Year

Learning How To Do It Through Plant Training

Walter H. Flinn

In the Plant Departments of the Bell System companies there are 190,000 men and women who plan, build, repair, and maintain the wire, cables, switchboards, and a host of other types of equipment, used in providing communications services. That is a big undertaking and a big responsibility, and all of these folks must know what they are doing. In fact, all of them must be *trained* in the knowledge and techniques of certain operations which keep the business going.

In the old days, a man became a skilled craftsman the long, hard way: through trial and error. Today there isn't time for that. Needed skills, basic crafts, and progressive accomplishments are acquired by being trained in them: trained systematically, intelligently—yes, even scientifically.

The purpose of training is to reduce the time required for learning, to improve the quality and quantity of production, and to promote safe working practices. Training is also an important factor in maintaining good public relations.

During the early years of this business, foremen hired and fired men on location. An applicant's climbing ability was indicated by his possession of "hooks." Not until the 1920s did the young apprentice receive much formalized training. Since this time, the need for sound training methods has been recognized. If a training program is to accomplish the desired results, the training must be tailored to fit the objective. Good training material cannot come from a haphazard collection of opinions, nor from experiences of any one individual, but must be based, instead, on extensive research into the most efficient methods for the particular task.

This doesn't mean that we don't have to practice over and over again, for we do; nor does it mean that we learn in a jiffy, for we don't. Much of the training consists of individual instruction on the job, and is planned and conducted by a man's supervisor. But here, let's just see how plant school training works.

A Post-War Recruit

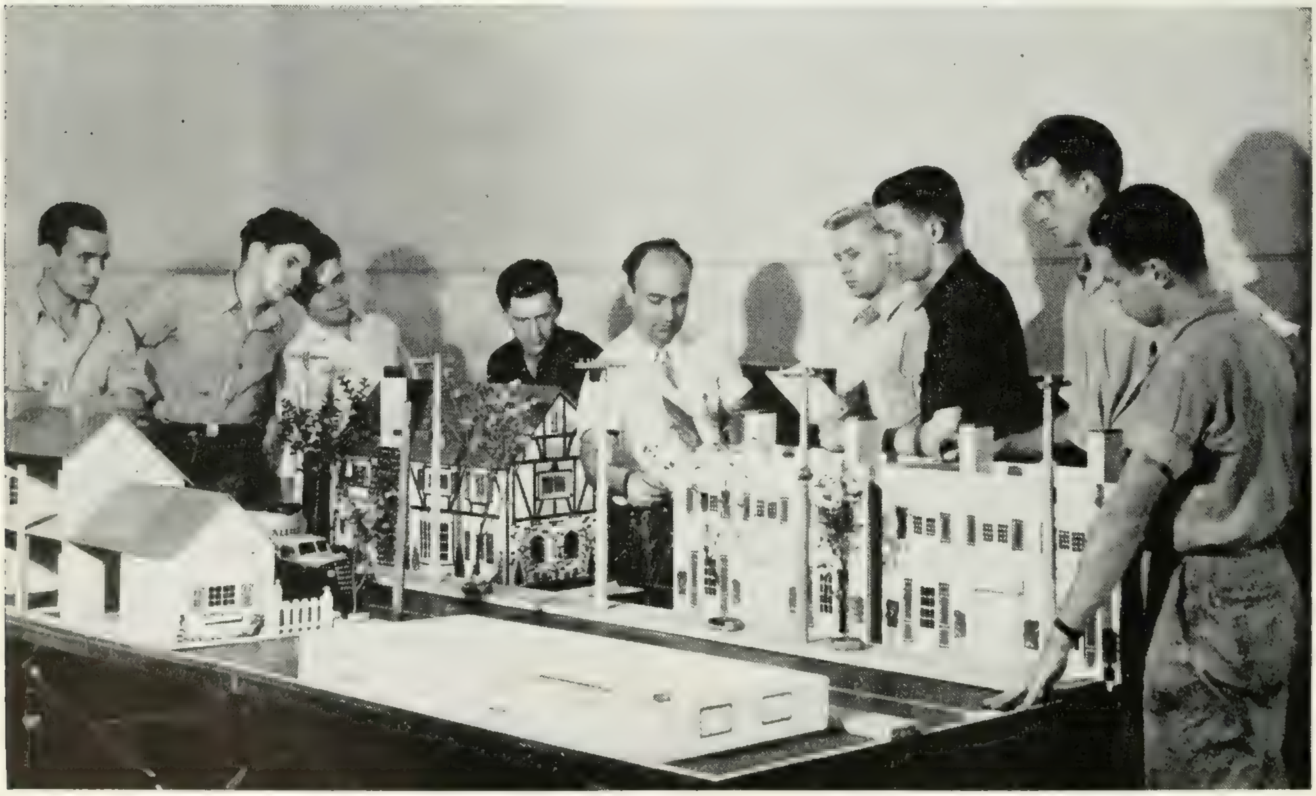
SUPPOSE WE take the case of John Smith, a young World War II veteran who came to the employment office of a Bell System Company in March of 1946.

The young man had received his honorable discharge just a week before. During the interview, he indicated that he had heard a lot about the Bell System from some of the G.I.s who were on military leave from the System. He said from all the things he had heard about the company, he was more than anxious to join its ranks.

He took the various pre-employment tests and showed up rather well in all of them. He was mentally alert, and had good coördination and mechanical skill. It looked as though John had the makings of a good station installer, and he was told to report to the District Plant Superintendent the following morning.

John was one of 1,500,000 men and women who came to the employment offices throughout the Bell System during the four years following the War. However, he was one of the more fortunate ones—for we found it possible to hire only one out of every 14 applicants who applied for employment during this period.

Needless to say, John was in the District Superintendent's office bright and early the next morning, full of vim and vigor and rarin' to go. Here John heard something about the Bell System family. He learned about the



A group of student installers make use of model homes in learning to plan residence telephone installations

An instructor demonstrates the techniques of pole climbing. Soon each pupil will be proving his proficiency under the expert's watchful eye

confidence the public has in us, and how proud we are of this reputation—and now that John had become one of the family, how we were counting on him to help us maintain that same kind of reputation. He was told how important it is to be pleasant, punctual, and regularly on the job to help meet our responsibility to our customers.

Here may be seen the early stages of training in action. It is true that John didn't know how to perform any of the work operations yet—but he began to acquire a better understanding of the kind of company for which he was going to work.

The next step in John's orientation program was to meet the foreman to whom he was to report as well as the

Typical residential construction, both exterior and interior, is simulated for these budding installers to practice on

Practical experience with aerial cable operations may be obtained under such favorable circumstances as these

other fellows in the gang. Here the foreman explained in more detail some of the things a station installer has to do in the performance of his work. John was informed that he was to report to the Plant school on Monday morning. There he would be assigned to an installation class with seven other men who had just been employed. He was told that he would go to school for two weeks and, at the end of that time, report back for assignment.

Some phases of the plant work can be taught more effectively in a school, where the learning situation can be controlled and teaching aids can be provided. In the Plant Department, the Plant school plays an important part in the over-all training of Plant people.

One of the first objectives in plant training programs is to orient new men in the business and train them so they will become productive and gain their useful place in the Plant organization as rapidly as possible. Why all the rush? Well, we are talking about the period since World War II, when the companies have had thousands upon thousands of requests for telephone service. Time was a real factor, for it had been necessary to more than double the 91,000 people in the Plant Departments at the end of the War. But most important of all, it's just good business to train each employee so he will have the knowledge and skill to perform his duties well. One of the real satisfactions in life comes from hearing such words as "A job well done"—particularly when they come from a customer.

Many Kinds of Training

The plant school to which John and the other new men were assigned has several class rooms. These are very flexible, and various types of training can be conducted in one room, for they are equipped with demonstration boards, visual aids, and actual telephone equipment. In the rooms assigned to installation training are telephone poles and cable and terminal boxes set up just as they are in the field, and sections representing home and office-building types of construction. Everything is done to simulate actual working conditions as nearly as possible.

Training requirements and class schedules within a given area are established at least three months in advance. Instructors are selected from all parts of the Plant Department: installation foremen, repair foremen, construction foremen, central office supervisors, and engineers. They have had actual field experience in the subjects they are teaching, and serve as instructors usually for one or two years. Together they work as a team with a single aim: to turn out well trained telephone people who can do their assigned jobs safely and efficiently.

Throughout the United States and Canada, over 300 Plant schools have been established to help care for the training needs of the Plant forces. Some of these schools are equipped to teach 50 to 100 different types of courses, and these courses range in length from a half day to 5 months. During 1952 approximately 104,000 Plant employees attended classes in the plant schools for an average of 5½ days each.

Regardless of where training is accomplished, it is a combination of learning and practice drill work. Training, in its broad sense, is never ending, but for practical purposes it is often said that training is completed when correct performance, both mental and physical, becomes habitual.

Some typical training courses:

First Aid
Advanced Installation
Dial PBX Installation and Maintenance
No. 1 Crossbar Dial Systems
Cable Splicing
Teletypewriter Maintenance
Ship-to-Shore Radio
Television Radio Transmission
N1 Carrier System

Let's look in on the installation class and see how John and the other new men got along on their first day in school. The subject they were discussing was Public Relations—and here's what the instructor was saying about it:

"Our relations with our customers and the public are controlled largely by the things we do as employees of this company. The opinions the public and our customers get in a great number of cases come from the actions of our employees both on and off the job. Quite frequently the only contact our customers have is through our installers and repairmen." They then discussed some of the things installers should do in their everyday job to promote good public relations, and the importance of being courteous, neat, and business-like at all times.

The next subject they discussed was safety, and the instructor explained the meaning of the Bell System Creed: "No job is so important and no service is so urgent that we cannot take time to perform our work safely." He also pointed out that the responsibility rests with the individual to make his own working conditions safe. He told the group that as they covered each phase of the job he would point out the safety features involved, because they are as important as the work item.

That brought them to the service order, and its relationship to the installation job. It didn't take the members of the class long to realize that the service order is the instrumentality which conveys the desires of the customer, and that the installer is a member of the team that will install the telephone to the customer's exact requirements. The instructor explained the part which each department contributes toward executing the service order, and again the men realized that the telephone job is one of teamwork, with each member occupying a very important post on the telephone team.

At the end of the first week John and the rest of the class were amazed at the number of things they had learned in such a short time about the tele-

Necessary skill in the use of a cable lasher may be gained in plant school

Practice in climbing and working on poles, acquired in school, brings confidence aloft

phone business. In addition to holding discussions, they were actually learning how to run wires, install telephones, and even climb telephone poles.

How to Climb a Pole

Perhaps we had better go back to the morning of the second day of the installation class, when the instructor asked "How many of you fellows have ever climbed a telephone pole?" Several of them indicated that they had done some pole climbing while in the Armed Forces.

The instructor told the class that during the two-week period they would devote part of each day to learning how to climb, and introduced the boys to what is commonly referred to as "hooks," or lineman's climbers. He explained that they were used for climbing and when working on unstepped poles, and that they should not be worn when not required. He emphasized that their very lives would depend upon these climbers, and assured them that the climbers were made to particular Bell System specifications, determined as a result of long years of experience in both field and laboratory testing.

The class was shown how to sharpen and gauge the gaffs of the climbers, so they would always be in top-flight condition. Then each man

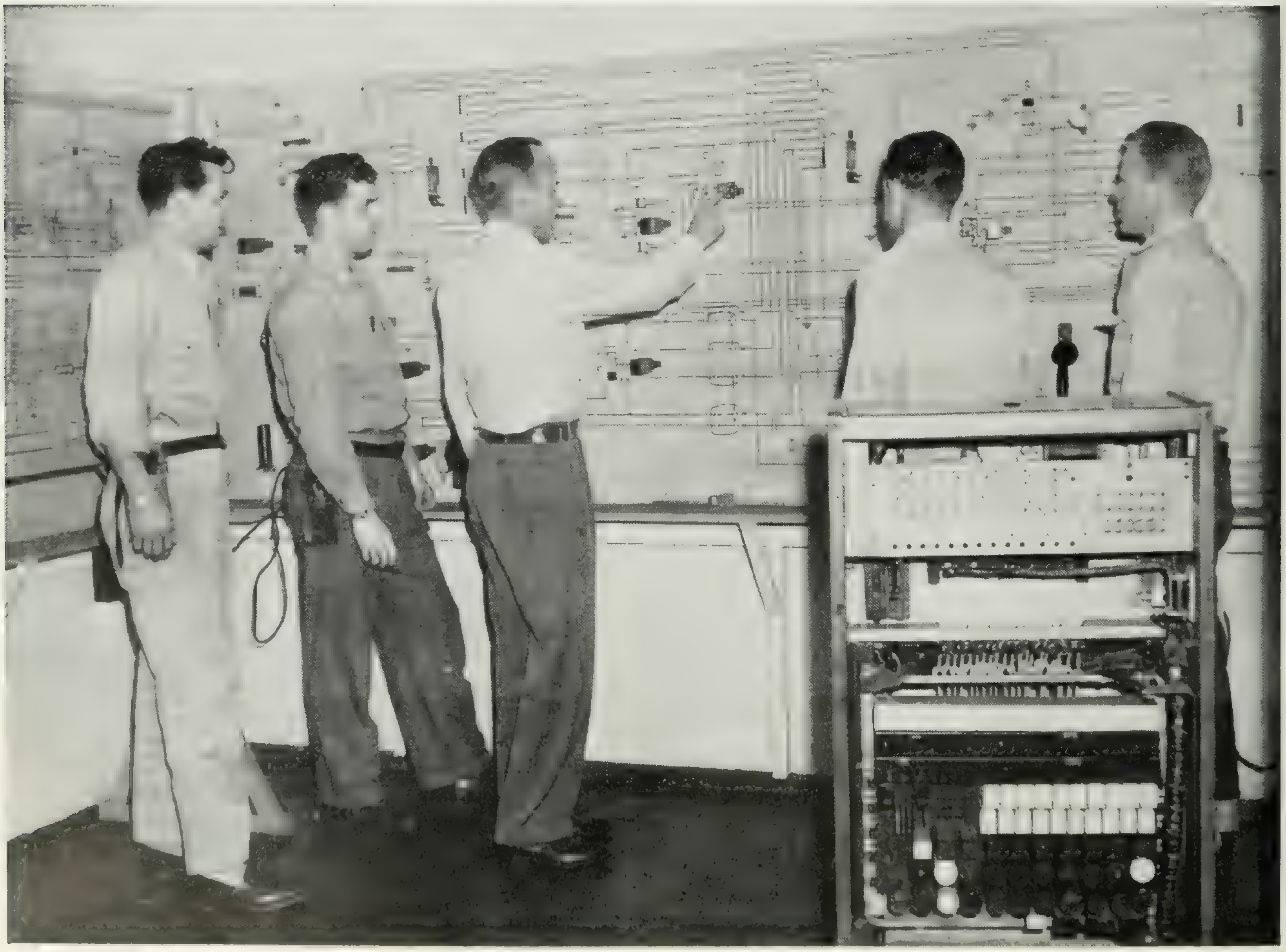
HOW TO CLIMB A POLE

John was instructed that the length of the first step should be about 8 inches from the ground. He was to keep hips, shoulders, and knees a comfortable distance from the pole and to apply sufficient pressure to force the gaff into the pole. (The weight of the body is usually sufficient.) He was then to proceed to raise the body into position for the second step. The hand on the side of his body on which the leg was moving up was raised slightly before the foot. After the second gaff is placed, the first gaff is removed from its position in the pole by shifting the weight to the other leg and lifting the gaff out of the pole. The free gaff is then raised upward for the next step. Short steps are taken when one is learning to climb. The distance between steps will lengthen naturally with practice. The same principles apply for descending the pole; the weight of one's body should ordinarily be sufficient to set the climber gaffs securely when descending.

was measured for his climbers, and taught how to wear them properly.

The next phase of climbing instruction was given outside, in a yard next to the plant school. Here poles had been placed in conditions simulating real field conditions.

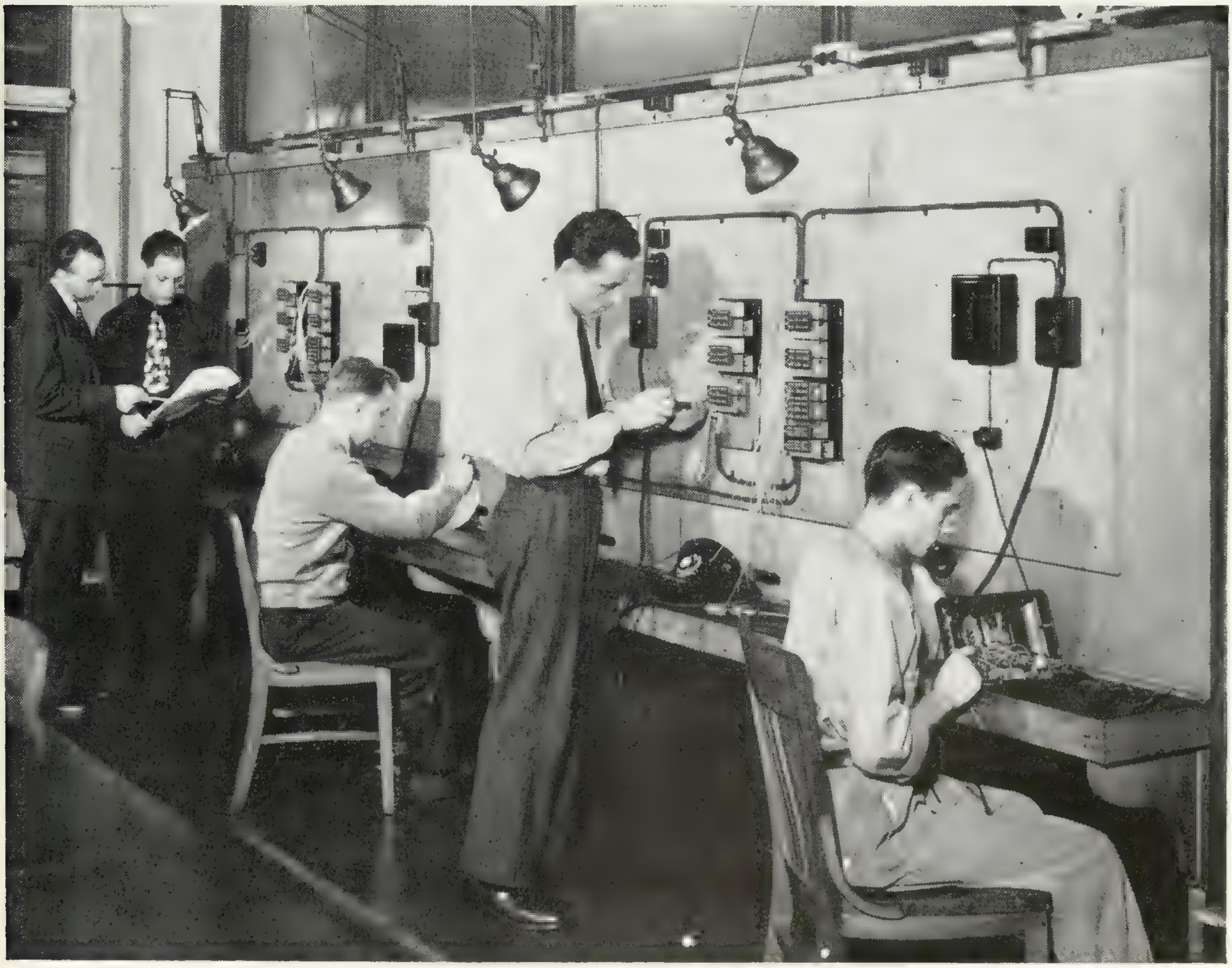
Before any man could learn to



Circuit layout is an important feature of PBX work climb a pole successfully, the instructor stressed, he must have confidence in his ability to learn to climb and in his climbing equipment. The instructor demonstrated the correct techniques by climbing repeatedly up the pole about three feet and down again. Then he asked each man to stand at the base of one of the poles without his climbers. Each was instructed to place his feet against the base of the pole at about a 45° angle, with the side of the arch of each foot against the sides of the pole. Then he was instructed to extend both arms forward in a horizontal plane from the shoulders, grasping the pole with both hands, and thrusting his hips well back from the pole with legs and arms straight. He was taught to move his legs up and down as though he were actually climbing a pole. (These exercises are very important, for they limber up muscles which are not ordinarily used.)

Now the men were ready to put on their climbers. At first they felt quite awkward, for they had to learn to walk with their legs spread far enough apart to prevent the gaffs of the climbers from cutting their feet or legs.

The instructor selected John as the first member of the class to climb a pole. The other members of the class gathered around the pole to watch. Then each man was given the same instructions as John and the opportu-



Learning to install key equipment is an advanced step in craft training

Installation Curriculum

The two-week course in installation for new employees, which John completed, included such items as—

Selection of Tools and Materials
Bell System Practices
Placing Drop Wires
Placing Inside Wires
Standard Telephone Set Installation
Service Orders and Work Reports
Pole Climbing

nity for practice. And, like John, none was permitted at first to climb higher than three feet above the ground. By the end of the two weeks, every man in the class could climb to the top of the pole and descend with confidence. Yet it is only through much additional training and supervision on the job, by a man's foreman, that he will develop into a skilled installer.

Use of a relay test set is being demonstrated by an instructor in a plant school

During the two-week period John and the other members of the class had learned many things about the installation job. Through discussion and practice, they had also caught something of the spirit and tradition of our business. Now the initial training was over. It was time to go to work.

John and his seven fellow students returned to their installation foremen. For the next couple of weeks, he went out with an experienced installer, watching, helping, gaining experience. Soon came the day—and the thrill of pride—when John received a truck of his own, and, in company with his foreman, tackled his first assignment.

In the months that followed, his foreman continued his on-the-job training, following up, inspecting, and giving John instruction and help and encouragement, until he was satisfied that John was a competent member of the Bell System team.

Keeping Pace with Progress

An important training objective is to keep pace with the technological changes and improvements in the communications art. In a business such as this, where these are occurring almost continuously, it is very impor-

These technicians are being coached at a regional Plant school in the operation of the new N1 carrier system

tant that there be people trained to meet these situations. Advance preparation for a new development may begin as early as three to five years before the first commercial installation is placed in service.

A typical example of this is the N1 carrier telephone system. The development of the system began in September 1947, when Bell Laboratories engineers started to design a carrier system for short-haul cable carrier operation. It was to be used for distances of 15 to 200 miles, capable of being applied to exchange cable facilities, at a relatively low cost. The first field trials were begun in July 1948 on the Milwaukee-Madison cable route in Wisconsin. These trials were continued until January 1950, when development had been completed and standard models of the equipment were being produced by the Western Electric Company.

Training entered the picture formally in May 1949, when the first conference on this matter was held. The first System school was held in the Wisconsin Company's territory, in keeping with the principle that training is best accomplished at a location where equipment is readily available for practical work by the students. Two System instructor classes were held, with representatives from 15 areas in attendance. These instructors, in turn, carried out the training in their own companies to meet service dates starting in September 1950.

The original course material was revised in December 1950, using the experience to date and incorporating new developments in the system. The new material was presented to two additional instructor classes, where 13 areas were represented, during January and February 1951, at Indianapolis, Indiana.

Necessarily, the original training outline was largely theoretical in nature, since the course was written when there was relatively little experience with the operation of the system. Two years later, in June 1952, the System-wide knowledge acquired during the last years of commercial usage of the system was taken into account in a further revision of the course material. The approach adopted in this revision was to tie together the over-all system concepts of circuit operation, with emphasis on problems of installation and maintenance, in order to prepare the craftsman more adequately for the job to be done at the central office location, where service and cost are carefully measured.

Thus it can be seen that the preparation for training on a new technological development may start soon after the inception of the research project, and continue until a new system becomes so common as to be included in the regular training for a particular craft. It is necessary to plan well in advance of actual needs in order to have the course material, instructors, and other essentials ready to do their part in the never-ending job of providing better service to our customers at the lowest possible cost.

In all training, it is important to give the reasons "why" as well as the "what" and "how." This encourages an employee to reason things out for himself when he encounters unusual situations.

Long range planning, forecasting training needs for such things as N1 carrier systems, crossbar central offices, and No. 4A switching centers represent but a part of the over-all plant training program.

New Times, New Needs

TODAY, the training demands on the Plant school staffs are indicative of a fabulous era of scientific advances into which the telephone industry is moving. Training requests are now characterized by such new-sounding words as transistors, microwave radio relay, mobile telephone, automatic message accounting, and broad band carrier—to name a few. Such talk, coupled with other expressions of increased service requirements and the need for good technicians, places added emphasis on the importance of the training job.

Training, both in plant schools and on the job, is a powerful instrument for building sound attitudes and good morale. A telephone employee who doesn't know his job feels insecure before customers and his fellow employees. On the other hand, if he is well trained—as was our young man John Smith—he will have confidence in himself and will enjoy the challenge of the tasks he must perform.

Excerpts from the Annual Report for 1952

For many years the Independent and Bell telephone companies have worked together cordially and effectively; the lines of some 5,300 Independent companies serving nearly nine million telephones interconnect with Bell System lines to provide a truly nationwide telephone service. As the needs of the public grow and change, all the companies keep in close touch to solve common problems. A particular point of common interest is to extend and improve telephone service to farmers. Since the war the Bell companies have added more than two million telephones serving customers in rural areas. In addition to working with their Independent company neighbors, they are coöperating also with the Rural Electrification Administration of the Federal Government to help meet farm telephone needs in other areas.

*

Close coöperation between the research, manufacturing and telephone operating organizations of the Bell System has had an important effect in enabling us to introduce improvements rapidly and prevent costs from rising higher than they have. The Bell Telephone Laboratories have pioneered development of better equipment. Western Electric has produced it in quantity at prices that mean large savings to telephone users. Telephone company engineers and operating people have devised better ways of using it. The interchange of experience between operator, builder and designer—all of whom are equally interested in improving service—is the best basis for telephone progress.

*

With the continuing growth of telephone service, the work of the Bell System touches more and more people—as customers, as owners of the business, and as employees. There are now more than 1,200,000 share owners and nearly 700,000 men and women are employed. These are large figures. They are most meaningful when we remember that they represent that many individual people, and their families, in communities across the nation.

Ours is a home-town business in each community. Good telephone service has grown from the personal concern of telephone men and women to serve their neighbors well. The company's relationship with each share owner also rests on the sense of personal responsibility. And in the planning and supervising of telephone work, as well as in each act of service, it is the individual efforts of employees in each community that spell out our progress. The people of the Bell System turned in a fine performance in 1952. We can be sure that the success of the business will always depend on the experience and skill of the men and women in it, and on our devotion to meeting every telephone need of our neighbors and fellow-citizens who rely on us.

Nine Countries Reported Over a Million Telephones Each And Six Had More Than 15 Telephones per 100 Population At the Beginning of Last Year

The World's Top Countries —Telephone-Wise

Elizabeth Wrenshall

FOR THE THIRD successive year, some four and one-half million telephones were added to the world network, thereby bringing the total number of telephones in service to 79,400,000 on January 1, 1952. For every two telephones in the world on V–J Day there were three at the beginning of 1952. Nearly 60 per cent of the world total were in the United States, where, on the average, every three persons had one telephone available to them. In the world outside the United States, every sixty-eight persons, on the average, would have had to rely on one telephone for service.

Each year the Chief Statistician's Division of the American Telephone and Telegraph Company publishes a statistical survey of telephone facilities by countries, entitled "Telephone Statistics of the World."

The data presented here are as of January 1, 1952, and we are frequently asked why there should be a time-lag of nearly a year between the date for which the figures are reported and the date of publishing the bulletin. Collection of any statistics on a world basis involves an appreciable amount of time. In this case, questionnaires were sent to nearly 300 administrations or private operating companies. Time consumed by the post; the fact that for certain administrations data are reported as of March or June, and therefore are not available until later in the year; time required by some of our correspondents to assemble statistics and by us to process them—these account for the fact that this survey which presents data as of January 1 is published eleven months later.

Nine countries reported more than one million telephones each in service on January 1, 1952: United States, United Kingdom, Canada, Federal

Telephones Per 100 Population

January 1	*World*	*Europe*	*United States*
1890	.03	.05	.34
1900	.1	.2	1.3
1910	.6	.6	7.6
1920	1.1	1.1	11.9
1930	1.8	1.9	16.3
1940	2.0	2.7	15.9
1950	3.0	3.3	27.0

Republic of Germany, France, Japan, Sweden, Italy, and Australia. Six of the world's principal countries had more than 15 telephones per 100 of the population: United States (29), Sweden (25), Canada (22), Switzerland (20), New Zealand (20), and Denmark (18). It may be of interest to consider briefly the development of the telephone system in each of these countries.

United States

Conditions were favorable to the early development of the telephone in the United States, the land of its birth.

There were no dense jungles to be conquered, as in South America; no polyglot populace, as in Asiatic countries; and no extensive uninhabited areas, as in the cold northern countries or in Africa's desert regions. The natural resources of the United States, the early industrial development, the high standard of living, the system of free enterprise, our national characteristics, our great market potential—all these have combined to produce a telephone system through which, today, three-fifths of the world's telephones serve our population comprising one-sixteenth of the world's people. The entire telephone industry—research, manufacture, and operation—has been conducted under private ownership in the United States from the beginning. On January 1, 1952, although the Bell System—comprising the American Telephone and Telegraph Company and its 20 principal telephone subsidiaries—operated more than 80 per cent of this country's 45,636,437 telephones, there were about 5,400 other privately-owned telephone companies furnishing service in the United States.

The large metropolitan areas are served by extensive systems. New York City, with 3,349,323 telephones at the beginning of 1952, had more than any foreign *country* with the exception of the United Kingdom. Yet New York had only seven per cent of this country's total telephones.

This situation differs greatly from that obtaining in the majority of large countries. Thirty per cent of the United Kingdom's telephones were concentrated in Greater London. The seven per cent of France's inhabitants living in Paris were served by 27 per cent of that country's telephones. Although our ten largest cities, in the aggregate, had 9.5 million telephones—or more than served all the inhabitants of Middle America, South America, Africa, Asia, and Oceania combined—they had less than 21 per cent of the nation's total. The more even distribution of telephone facilities within the United States is indicative of the good service available to rural as well as to urban residents.

The table on the preceding page illustrates comparative telephone development by decades from 1890 for the World, Europe, and the United States.

United Kingdom

THE TELEPHONE SYSTEM of the United Kingdom of Great Britain and Northern Ireland is owned by the government and operated by the General Post Office, with the exception of the municipally-owned local systems serving the city of Hull and the islands of Jersey and Guernsey.

The telephone was introduced into the United Kingdom in 1878 through private companies, all of which, by 1892, had been consolidated into the National Telephone Company Limited. The government took over the company's trunk service in 1896, and its local service upon termination of the company's franchise in 1912.

On March 31, 1952, there were 5,724,440 telephones in the United Kingdom, of which 99 per cent were operated by the Post Office. The system serving the United Kingdom was the second-largest in the world in point of number of telephones in service. There were 11 telephones per 100 persons. An average of 70 calls per capita were made during the year under report.

Canada

CANADA'S SYSTEM ranked third among those of the world both as regards actual numbers and number of telephones per 100 of the population (22). Of the estimated total of 3,140,000 telephones at the beginning of 1952, 86 per cent were operated under private ownership, the balance by municipal, provincial, or Dominion ownership. Canada reported a higher per capita calling rate for the year 1951 than any other of the world's principal countries, or 378, as compared with 376 for the United States.

Germany

THE GERMAN FEDERAL REPUBLIC—roughly half the size of pre-war Germany—was served by 2,700,104 telephones at the beginning of 1952, which reflects a development of 6 telephones per 100 persons.

An attempt by private interests to secure local franchises in 1876 was unsuccessful. Of Europe's principal countries, Germany was the only one in which the government assumed operation of the telephone system from the beginning. The Director of Telegraphs, Stephan, was extremely interested in the potential practical applications of the telephone. By 1878, he had interconnected by telephone fifteen country post offices which were without telegraph service. By 1880, several thousand telephones had been installed in the post office buildings, but it was not until 1881 that local exchanges were constructed in the Imperial Postal District by the Post and Telegraph Administration.

Prior to the war, Germany's telephone system was the world's second-largest. On January 1, 1952, the system serving Western Germany was fourth-largest. An average of 46 conversations per person was reported for 1951.

France

The telephone system of France, with a total of 2,520,762 telephones, ranked fifth in size among those of the world at the beginning of 1952. The development of 6 telephones per 100 inhabitants is rather low as compared with that of other principal countries, as is also the average per capita calling rate of 41 conversations reported for 1951.

When the telephone was introduced at the World's Fair in Paris in 1878, the government stated that all operation of telephone service would be reserved to the government. Instead, however, the government granted franchises to three private groups which combined in 1880 to form the General Telephone Company. The first local exchanges were opened in Paris in 1881. By 1885 there was such a demand for long distance lines that the government decided to construct and operate them. On expiration of the local service franchises in 1889, the government purchased the General Telephone Company's local plant, and since that time has continued to operate all telephone service in France. The administrative organization of communications services in France has been changed some half-dozen times. Since 1930 these services have constituted the Ministry of Posts and Telegraphs.

There is no party-line service in France, but extension subscriptions are offered whereby a subscriber has

TELEPHONES IN CONTINENTAL AREAS

January 1, 1952[a]

Continental Area	Total Telephones			Privately Owned		Automatic (Dial)		Connecting with Bell System	
	Number	Per Cent of Total World	Per 100 Population	Number	Per Cent of Total Tels.	Number	Per Cent of Total Tels.	Number	Per Cent of Total Tels.
North America	48,796,300	61.5	28.7	48,353,000	99.1	34,909,100	71.5	48,778,000	100.0[b]
Middle America	593,700	0.7	1.1	540,500	91.0	422,700	71.2	586,800	98.8
South America	1,931,000	2.4	1.7	966,200	50.0	1,468,400	76.0	1,830,200	94.8
Europe	22,362,000	28.2	3.6	3,453,400	15.4	15,903,500	71.1	20,611,400	92.2
Africa	986,000	1.2	0.5	18,200	1.8	648,800	65.8	853,600	86.6
Asia	2,944,000	3.7	0.2	213,100	7.2	1,393,000	47.3	1,832,000	62.2
Oceania	1,787,000	2.3	12.2	125,400	7.0	1,156,400	64.7	1,775,100	99.3
World	79,400,000	100.0	3.3	53,669,800	67.6	55,901,900	70.4	76,267,100	96.1
United States	45,636,437	57.5	29.3	45,636,437	100.0	32,900,000	72.1	45,628,369	100.0[c]

[a] Partly estimated; statistics reported as of other dates have been adjusted to January 1, 1952.
[b] Less than 0.04 per cent do not connect.
[c] Less than 0.02 per cent do not connect.

The World's Telephones

The continued great excess of demand over supply of telephone service in Japan has given rise to a situation, described two years ago in *Telephony* magazine, which seems fantastic to a Western observer. A recognized brokerage business for filling applications for telephone service has long existed in Japan. As much as the equivalent of $3,000 has been paid for the "right" to buy a telephone. Telephones owned by persons moving away from the city, those inherited from a deceased subscriber, or those which are to be sold for some reason, are purchased by a broker and resold. As a business firm lists after its name in the directory the telephone numbers of employees, and as a long list contributes to the firm's prestige, the man who owns a telephone has a better chance of getting a job than has the man without one. Ownership of a telephone may constitute an inheritance, a dowry for a daughter, or collateral against a loan. A lucky number—one homonymous with a word having a pleasant connotation—commands a high price. An unlucky number may bring a price differential as great as $300. An example of a number in disfavor among inhabitants of the "Flowery Kingdom" is any combination ending in "42", for "42" is pronounced "shini", which also means "to die."

access to the network through the station of a principal subscriber.

Japan

JAPAN had 2,013,439 telephones on March 31, 1952, or 2.4 telephones per 100 of the population. Nearly 70 per cent of Asia's telephones are concentrated within this small country.

Telephone service was first offered to the public in Japan in 1890, when the government opened exchanges in Tokyo and Yokohama. The domestic telephone system was operated by the Ministry of Communications until August 1952, when an administrative reorganization placed this service under the newly created government agency called the "Nippon Telegraph and Telephone Public Corporation."

Development of the telephone was slow in Japan. There were 0.4 telephones per 100 population in 1915, 1.9 in 1939. Because of costly armament and naval programs, destructive earthquakes, and severe depressions, provision for expansion of the telephone system was postponed in favor of other national programs.

Due to the shortage of equipment, Japan's annual calling rate per telephone is extremely high—about 4,000, as compared with 1,300 for the United States in 1951. However, the per capita calling rate was 89 for the same year. During the war, 55 per cent of subscribers' telephones were disabled or destroyed. Great progress in reconstruction has been made since the termination of the war, and the present number of telephones is the largest in Japan's history. Continued progress is indicated under the new telecommunications administration.

Sweden

AS REGARDS ratio of telephones to population, Sweden, with 25 telephones per 100 persons, ranks second only to the United States. Stockholm is the only foreign city in which telephone development (50) approximates that obtaining in the most highly developed urban areas of the United States.

The International Bell Telephone Company built Sweden's first telephone exchanges in 1880. The Stockholm General Telephone Company entered into telephone competition in 1883, and shortly thereafter development of service in small communities was begun vigorously. By 1885, there were fifty mutual and coöperative societies and small local corporations. In the meantime, the government granted authority to the Telegraph Board to construct lines in places which were without service. Thus, the Swedish Government began to compete with private telephone companies, and gradually purchased local telephone plant throughout the country.

On January 1, 1952, Sweden had 1,788,874 telephones available to the public. All but 1900 of these were operated by the government through the Royal Board of Telegraphs.

Party-line service is seldom used in Sweden, and is available to rural customers only. In domestic toll service, "Urgent" and "Lightning" categories of call are offered at twice and twenty times the ordinary rates, respectively. The average number of calls per person in 1951 was 310, placing Sweden third in this respect among the world's principal countries.

Italy

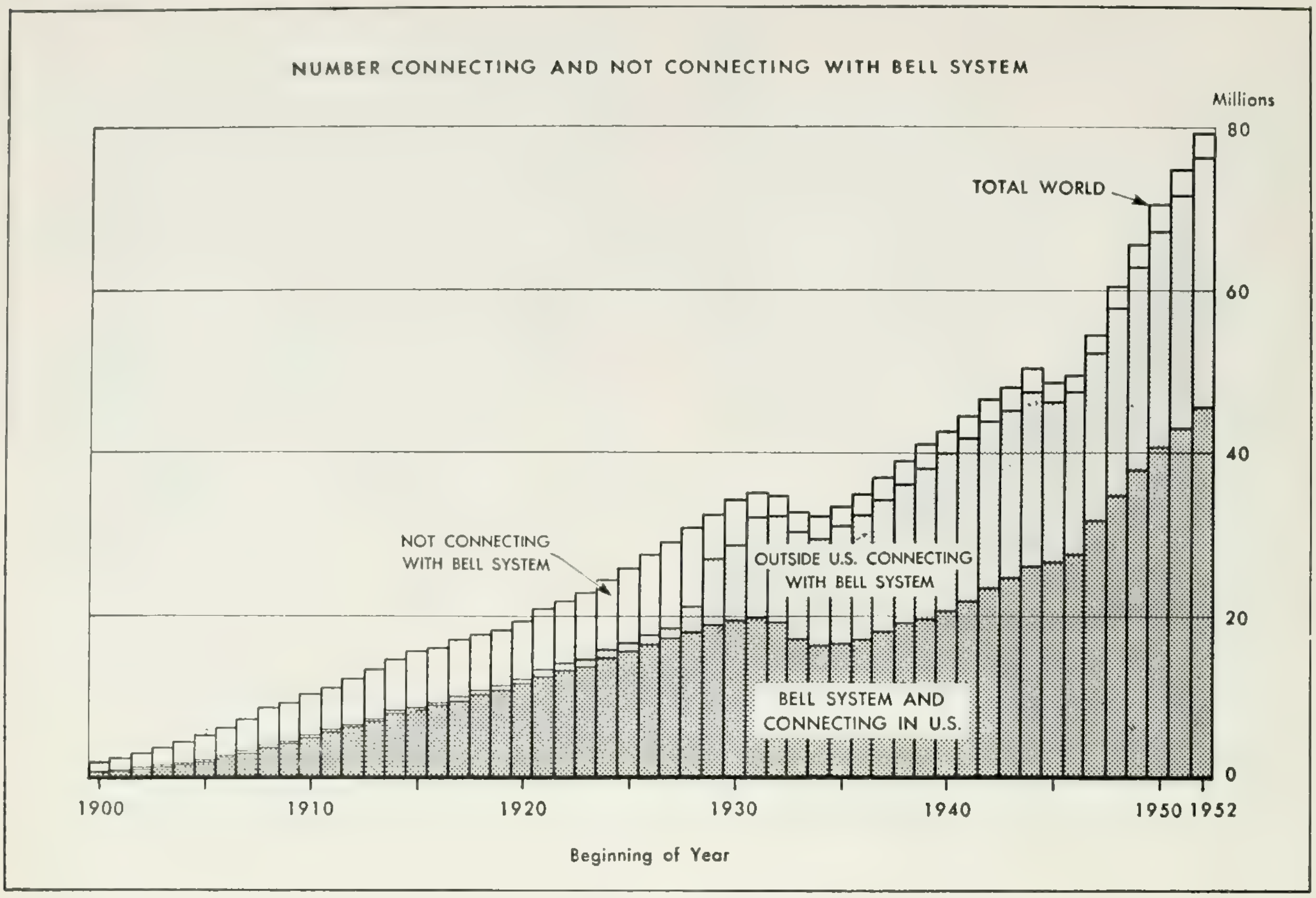
ITALY'S TELEPHONE SYSTEM ranked eighth in size among those of the world. Its 1,382,438 telephones in service at the beginning of 1952 were operated by five concessionary companies, each of which provides local and toll service within its respective zone. Interconnecting long distance service is operated by the government through the Government Agency for Telephone Services.

Telephone service was initiated in 1881 by private companies operating under franchises granted by the government. This was a period of social unrest and labor disturbance, and the government was not disposed to assume the risks of developing the new business. In succeeding years, however, it constructed toll lines and local networks. The granting of more than one franchise for one city made normal progress impossible. The various laws were unified in 1903, and in 1925, under Mussolini's reorganization program, the structure of Italian telephone service was given the form obtaining today.

On January 1, 1952, Italy's telephone development was three telephones per 100 of the population. The per capita calling rate for the year 1951 was 50. In domestic toll service, the charge for an "Urgent" call is three times that for an ordinary call, and for a "Very Urgent" call there is an additional charge of 200 Lire per 3-minute unit. In purchasing equipment, the operating companies must give preference to national industry unless its prices exceed those of foreign industry by more than 10 per cent.

Australia

THERE WERE 1,259,212 telephones in Australia at the beginning of 1952, or 15 per 100 of the population. An



The World's Telephones

average of 122 calls per person were made in 1951.

The first telephone system in Australia, the Melbourne Telephone Exchange Company, Victoria, was established in 1880. The company was unable to secure franchises from the other state governments, which began to construct their own systems. The Victoria State Government purchased the privately-owned company in 1897. Since the formation of the Commonwealth of Australia in 1901, all telephone service has been in the hands of the Commonwealth government, and is operated by the Department of the Postmaster General.

Switzerland

SWITZERLAND ranks second to Sweden among European countries in telephone development, with 20 telephones per 100 persons. The telephone system is under the jurisdiction of the Director General of Posts, Telegraphs and Telephones.

Early progress of the telephone was rapid in Switzerland. At the beginning of 1911 there were 2.1 telephones per 100 inhabitants in Switzerland, 1.5 in Great Britain, 1.6 in the German Empire, 8.2 in the United States. The first exchange, opened in Zurich in 1880 by the International Bell Telephone Company and having 141 main lines, was operated under a government franchise until 1886, when it was purchased by the government administration. In 1890 the national network comprised 9,492 main lines.

In domestic service (local and toll) in the year 1949, 96 per cent of calls were established through automatic switching. Party-line service is available only in remote places, where two subscribers at most are connected on the same line. At the beginning of 1952 there were fewer than 50,000 party lines. The populace of Switzerland averaged 152 calls each in 1951.

New Zealand

THERE WERE 394,566 telephones in New Zealand on March 31, 1952, all of which were operated by the General Post Office. The telephone development per 100 population, 20, is the fifth-highest among the world's principal countries. New Zealand's four largest cities have 37 per cent of the country's population, 39 per cent of its telephones.

The first telephone exchange was opened by the government in 1881. Remarkable progress was made, for at the beginning of 1914 there were 4.6 telephones per 100 of New Zealand's population, while the development for Great Britain at that time was 1.7, for the German Empire 2.1, France 0.8, Spain 0.2, the United States 9.7.

Since nearly two-thirds of New Zealand's people live in rural areas, where multi-party service is offered, the proportion of party-line to total telephones is high, being about 35 per cent. New Zealand does not report conversation data, inasmuch as local service is offered on a flat-rate basis and no count of local calls is made.

Denmark

ON JANUARY 1, 1952, Denmark had 760,244 telephones in service, 95 per cent of them being operated by three private concessionary companies. The government, through the Direction General of Posts and Telegraphs, operates interconnecting long distance service throughout the country, and local service in South Jutland, on Moen Island, and in several small localities. A development of 18 telephones per 100 of population places Denmark sixth in this respect among the world's principal countries.

The first telephone service in Denmark was given in 1880 by the International Bell Telephone Company, which sold its plant two years later to a Danish corporation, the Copenhagen Telephone Company. This company currently operates some 60 per cent of the country's telephones.

Party-line service is offered in Denmark, party lines constituting 15 per cent of the Copenhagen Telephone Company's total number of lines. The average number of calls per person reported by the Director General for the country was 257 for 1951, which places Denmark fourth among the principal countries in this regard.

THIS INFORMATION has been expanded from material in the most recent issue of "Telephone Statistics of the World," which is almost wholly statistical in content. A copy may be obtained upon request to the Chief Statistician of A. T. & T.

In Three Years 6,500,000 School Children Have Learned To Use the Telephone Properly through a Bell System Motion Picture and Associated Teaching Aids

"Telezonia" and the 3 R*s*

LeRoy A. Born and Stuart D. Harter

THE TELEPHONE is today as much a part of the child's daily life as of the adult's. Teaching its proper use is, of course, the responsibility of the parent and the school. The role of the telephone companies is to provide, if and when asked, authentic information which the experience of the business has shown to be helpful to telephone users of whatever age.

In 1952, more than 2,000,000 children in some 70,000 classrooms learned how to use the telephone properly: learned through a specific educational program sponsored by the Bell telephone companies. Since its introduction in 1950, the program has been effective in teaching about six and a half million children in public, parochial and private schools.

As a result, fewer receivers are left off the hook, party-line interference is decreasing, and dialing habits are improving—especially among the younger generation.

The program is based on a color motion picture, "Adventure in Telezonia," * about a boy and his dog. But it is made effective by the addition of a package of materials which includes a silent filmstrip † for classroom discussion, a pamphlet for children on how to use the telephone, a teacher's guide explaining the material, and two local directories and a pair of telephones so the children can take turns practicing what they learn.

The Telezonia program has been accepted by over half the country's school systems, and requests for the material have come from as far away as Japan and the city of Bagdad. A French version produced by the Bell Telephone Company of Canada for use in the Province of Quebec has been well received by French children.

Introduction of "Telezonia"

TO HELP EQUIP the telephone manager in each community to carry out the Telezonia program, training in its purpose and objectives was needed; procedures had to be devised and written to conform with varying local situations; and interviews with school superintendents, administrators, and teachers had to be planned and carried out.

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* See "Adventure in Telezonia," Magazine, Spring 1950.

† A series of still pictures on a strip of film for projecting on a screen one at a time.

These tasks were made easier because school people recognized that help had been received from educators in the preparation of the material so it would fit into school teaching methods. Wayne University, in Detroit, Mich., acting as consultant to the Bell System in the preparation of the motion picture and development of the teaching material, found from questioning over two thousand school principals that there was an educational need for teaching good telephone usage and that it should be taught in about the fourth grade. That is where it is being used in most schools today.

When the material has been accepted in a school system, there is still more to do. For between acceptance and use lies the problem of supply. Many school systems have central libraries controlling film circulation. Some are equipped to handle other teaching aids, such as booklets, practice telephones, and directories. Others are not, and may prefer that all or parts of the kit be ordered directly by the individual school or teacher through the local telephone company office. Local telephone managers over the entire country are working closely with the schools to meet their needs and at the same time make best use of the 2,000 prints of the motion picture and some 3,600 filmstrips which are available.

After Telezonia has been accepted and put into use come frequent follow-up visits with principals and teachers to exchange up-to-date experiences received from other schools, so that all may use the material effectively. Educators and teachers have asked for this help in bringing to them experiences of other teachers.

> *"Who is in the better position to tell of the miracles of 20th century communications than the Bell Telephone Companies? . . . Adventure in Telezonia . . . represents one of the most fascinating developments in the field of the sponsored film . . . the contribution of the American Telephone Company to the schools of America."*
>
> John Guy Fowlkes, Dean of the School of Education, University of Wisconsin, in the foreword to the 1950 Edition of "Educators' Guide to Free Films."

Classroom Use

THE MOTION PICTURE and filmstrip are helping the children understand good telephone usage and the importance of the telephone in their daily lives. Pupils are taught through classroom practice how to apply the principles they have learned, by simulating conversations over the telephone instruments and by looking up numbers in the local directory. The pupils are paired to take turns in "making" and "receiving" calls. Every step of the call is performed, from looking up the telephone number and writing it down, waiting for the dial tone or the operator's "Number, please?" as the case may be, dialing or giving the number to the operator, through the telephone conversation itself to the friendly goodbye and quiet replacement of the instrument.

Teachers devise many ingenious ways to impress on the children the importance of the telephone and its proper use. Attending a classroom session on Telezonia, as telephone people often do, is likely to be a fascinating experience.

First to strike the eye are posters which the children have drawn and pinned on the walls. Usually done with crayons, their gaudy colors and originality defy description. In one, telephone instruments dance weirdly around what seems at first to be a Maypole but which on further inspection appears to sprout insulator-studded crossarms, down which linemen are sliding cheerfully on their backs. In another, the march of time is portrayed by a smoke signal in the background under a carrier pigeon's baleful eye. But from behind this merry façade, the evidence shines through that the young Van Goghs have learned their lessons on telephone courtesy, coöperation, and good usage.

The elements of the Telezonia package

The alert attention of the youngsters to the Telezonia film itself, and their rapt interest in the teacher's carefully organized review with the filmstrip, are highly impressive.

And the discussion of the good-usage booklet, with its enthusiastic participants practicing their learning, will warm the hearts of telephone men and women.

Here are some of the various classroom uses to which teachers have adapted the Telezonia material:

Language and Vocabulary

Writing letters, stories, poems and songs about using the telephone.

Spelling and use of such words as party line, dial tone, mouthpiece, receiver, signal, number plate, switchboard, operator, directory, emergency.

Alphabetizing:

Looking up names in the telephone directory; making one's own personal directory of friends and tradespeople the child or his parents might call.

Picture-book project:

Making picture-books from magazine illustrations of people using the telephone and of telephone equipment.

Sand-table project:

Such as stringing a telephone line between houses and a central office.

Citizenship:

How to be good party line neighbors and knowing how to use the telephone in an emergency.

A telephone man and a teacher were chatting in a California class-

School children and a telephone company representative join forces to explain and demonstrate the Telezonia project to student teachers at a teacher training institution

room while waiting for the children to assemble. The former remarked: "Looks as though you can use Telezonia for about everything but arithmetic." A while later, during the class discussion, the teacher asked one child: "Sally, if it costs $1.65 to call from here, say, to Boise, Idaho, how many nickels, dimes and quarters would you put into a coin telephone to pay with the fewest coins?" As the child replied, the teacher glanced toward the telephone man with a certain gleam in her eye.

One classroom in Wisconsin uses long distance routes, furnished at the teacher's request by the Wisconsin Telephone Company, for teaching geography. A child places a "pretend" call from Milwaukee to New York or San Francisco while another child traces the route on a blackboard map. There is even a make-believe switchboard operated by one of the girls, and the class has designed a mock radio-relay tower for realism.

A telephone official visiting a school gathering in his home town found to his surprise that the children were reenacting the marionette story of Adventure in Telezonia with puppets they had made themselves.

A class in an Ohio school presented a playlet one Saturday morning before a Parent-Teachers Association meeting. Written by the pupils, it concerned a space-cadet named Tayo, who visited the earth from the skyland of Eros. He asked the earth-children about a strange black object he had noticed everywhere. When they explained that it was a telephone, and showed him how to use it properly, his timidity about it was overcome.

In another Ohio community, the school's audio-visual director inquired how the telephone company could supply answers to questions the children were asking about the telephone. Thereupon, the teachers using Telezonia were invited to visit and inspect the telephone building, after which they exchanged experiences in a round-table meeting. The audio-visual director later reported that in his opinion the teachers' effectiveness in using the materials had increased threefold.

Plant Participates

LAST SPRING, as part of a Telezonia program, an installer drove his truck into a Massachusetts schoolyard and parked. Behind him a Commercial Department man in a passenger car, Bell System seal on the door, drew up. Before the drivers could alight, a group of youngsters, teacher alongside, came marching toward them from the wide school doorway. As the installer took his position at the rear of the truck, the youngsters formed a circle around him, solemn save for the light of eager curiosity in their eyes.

There was a responsive light in the eyes of the installer, a reflection of his merry smile. "Hello, girls and boys. Anybody know what these are for?" As he brought forth tools and equipment, piece by piece, heads leaned forward and eyes grew bigger and more intense. Eagerness became vocal, first shyly. Then the trickles of response gushed forth in a tumbling flood of answers and guesses and questions.

First he told them how a telephone was installed, from the instrument to the pole. This led to safety: "Poles

A telephone installer explains his job to interested youngsters are too dangerous for even a big fellow like me to climb without this belt and strap. Electricity can be dangerous, too. Never touch a fallen wire. It can kill you. Even with these very special gloves, you have to be sure you know how to handle it."

Classroom practice in telephoning

When he was done, the commercial man at the rear car brought out a vehicle telephone from under the dashboard. "Know how this works? . . . . . . That's right, by radio. Let's call your school secretary." He passed the instrument from ear to ear. The call had to be short, for mobile telephone channels are very busy these days. "Like the party line some of you have at home. When your neighbor on the same line down the street wants to use it, I know you always end your call promptly. I know that, from the nice manners I see you all have." They didn't dare lift their slightly guilty faces to the skeptically amused glance of their teacher.

It was hard to tell who enjoyed the visit most—the children, the teacher, or the telephone men. But as to what the youngsters learned there could be little doubt. Back in the classroom, they drew pictures of what they had seen and heard and the details they recalled were amazing. Only an observer could fully realize the impact which must have etched in the minds of youngsters a new respect for the telephone and its courteous use.

A number of telephone companies are working with school people to organize various activities which teachers build around Telezonia into an integrated instructional program about the telephone and its use in modern living. Such a program would have great usefulness among new teachers entering the school system, helping them to a better understanding of the purpose and possibilities of Telezonia.

The effect of these classroom projects is to impress upon the child that using the telephone is an experience which he shares with his neighbors, and that using it considerately is one way of becoming a good citizen.

The enthusiasm of the child is often reflected in the home. Teachers tell us that parents often gratefully mention the beneficial effects of the instruction on the child's use of the telephone.

Press, Radio, and TV Mention

THE VALUE of Telezonia has been recognized by school publications, teachers' magazines of national circulation, the press, radio, and television. One mid-western newspaper told the story of Telezonia with four photographs in color from the motion picture. From coast to coast, newspapers large and small have told the story of how the telephone industry is working with schools and educators to bring to the community better telephone service through education of the younger generation.

A Massachusetts radio station broadcast a recording of a half-hour session on Telezonia in one of the schools. The program was made up by the children themselves, who explained the rules of good telephoning, presented skits about calling the doctor and the fireman in emergencies, and sang songs they had made up themselves.

As part of a "Partners in Progress" series, a California station televised a program in which four school children demonstrated good telephone usage by means of four skits on telephone calls and by explaining how to look up telephone numbers in the directory.

Teachers supplement their own understanding of the telephone by visiting a central office

As a result of an item about Telezonia in a national magazine, an eastern television station asked a telephone company representative to appear on a "housewives'" program to explain the Telezonia kit, and it was also discussed over a number of other local radio stations.

Informing Educational Groups

MUCH INTEREST in Telezonia has been expressed by teacher-education institutions, particularly in courses on the use of films and other teaching devices. One telephone company reports that the materials have become a part of elementary education courses at all state universities in its territory and have been presented in most of the teachers' summer courses throughout the region. In many cases, telephone company representatives are asked to take over entire class periods to present Telezonia and explain its use to student teachers.

Publicity originating from the telephone company has been limited to school people and, with their consent, to community groups—like the Parent-Teacher Associations—interested in the schools.

Several Companies have built displays for use at teachers' meetings and conventions and considerable use is made of these and of slidefilms and motion pictures.

It Proves to Be Effective

THAT TELEZONIA has been so widely accepted by the schools is a tribute to the educators under whose guidance

A Telezonia display shown at teachers' conventions and other educational meetings

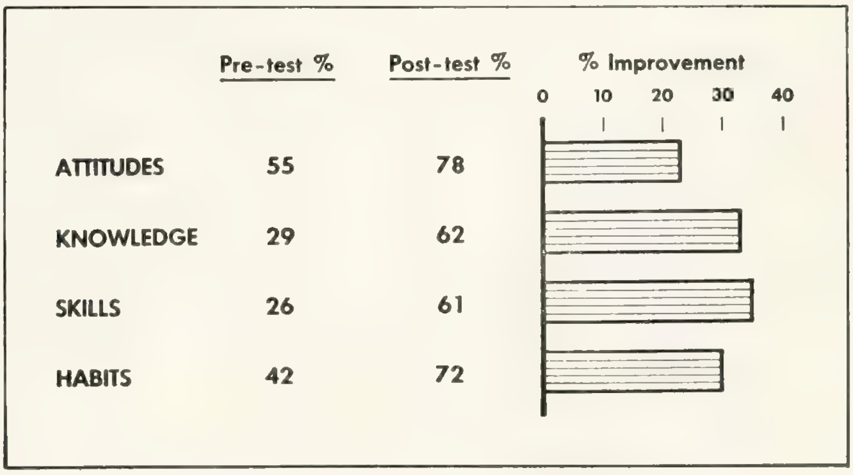
and counsel it was produced. It is they who suggested the teaching principles that underlie its form and content.

By the same token, it is the educator's province to say what the children really learn from it, what effect the teacher's use of it has upon their ability to use the telephone properly. Mr. Louis J. Schmerber, Superintendent of Schools in Paterson, N. J., determined to find out. A committee of six, his assistant and five principals, devised a test based on standard types of attitude and performance measurements used in the field of elementary education.

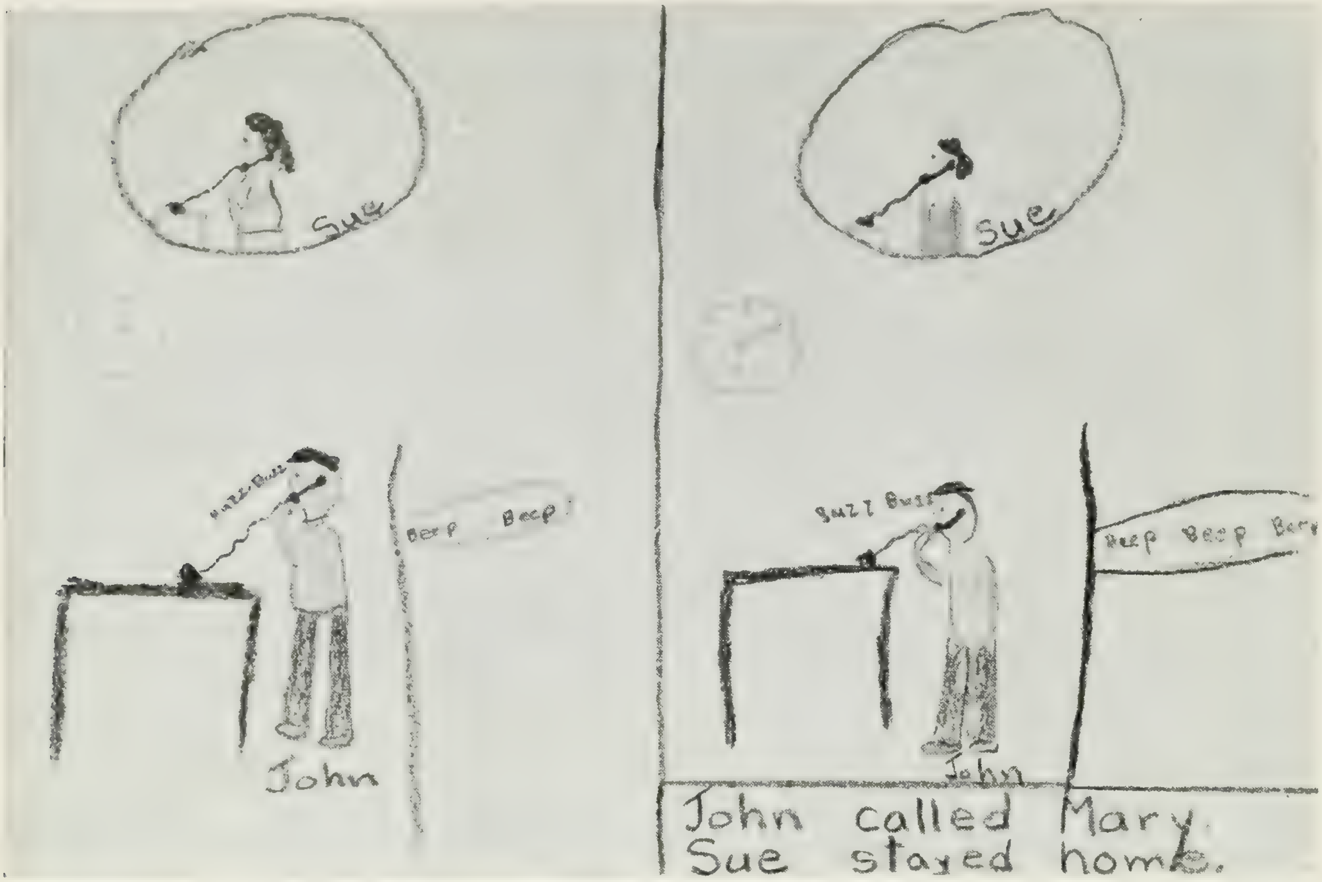
The test, given to fourth-grade pupils, is in two parts. There are four lists of questions for each child to fill out with a *yes* or *no* answer, first before and again after the Telezonia instruction. These are designed to test the effect of the instruction on the child's telephone habits, attitudes, knowledge, and skill according to the meaning of these terms in elementary education. The parents are also provided with these lists, so that they too can observe and check the child's actual use of the telephone at home.

An evaluation was made of the questionnaire part of the test given to all 792 pupils in the first term of the fourth grade in 21 public schools. The percentage of pupils reaching a perfect 20 or near-perfect 19 score on the pre-test was compared with the percentage reaching these scores in the post-test. The results appear on the accompanying chart.

The report of the evaluation to the superintendent stated: "From these comparative figures, it can be seen that there was marked growth in each area as the result of teaching the telephone unit, and that this growth



"*Before and After*" *Telezonia*



Telezonia inspires pupils to creative art

was greatest in skill and knowledge, in which areas the pre-tests were poorest."

Mr. Robert LeAnderson, Supervisor of Visual Education of the Detroit public schools, conducted an evaluation of a different type. One group of children was assigned to study only the student's booklet, another only the filmstrip, a third group only the motion picture, a fourth, called the "combined group," was exposed to all the contents of the kit except the telephone instruments. A fifth was used as a control against which the performance of the other four groups was measured. Each was equal to the others in intelligence level and reading ability.

It was found that each item in the Telezonia kit is of real help in developing skill and knowledge in the proper use of the telephone, and that learning is most effective when the materials are used in combination.

Other studies support these general conclusions.

The effect was measured in two mid-western cities where 38 of the 40 school systems taught Telezonia, involving 261 teachers and 9,267 students. Party-line interference cases decreased 18% in one city and 38% in the other. "Dialed calls abandoned" was down 54% and "customer dialing irregularities" was reduced about 31%. What part of these improvements can be definitely attributed to Telezonia would be difficult to estimate, because of the varied and continuing efforts to improve both party-line coöperation and dialing habits. However, local telephone people feel that it is more than a coincidence that the improvement took place after the introduction of an intensive Telezonia program.

The impact of teaching good telephone usage to over two million children each year, which represents about 60 per cent of the nation's fourth-graders, is being felt in all areas of the country.

Whatever success Telezonia enjoys and continues to enjoy is due to the ingenuity of all teachers, many of whom find unsuspected uses for it in carrying out their educational tasks. It is in like measure the result of the intelligent and painstaking work of hundreds of telephone managers, and the close coöperation of other local telephone men and women who help these educators in their efforts to inculcate in today's fourth-graders a greater respect for good telephone usage.

If the success of Telezonia to date is a presage of its future, it bids fair to have a place of its own in helping to prepare tomorrow's citizens for the world in which they will live. Learning at an early age how to use the telephone properly is the first step in forming and retaining good telephone habits.

Twenty-five Years Ago in the Bell Telephone Quarterly: Volume VII, Number 2

A. T. & T. officials at an A. I. E. E. session in New York on February 16, 1928, held jointly with a session of the British Institution of Electrical Engineers in London by radio telephone. Left to right, seated: H. P. Charlesworth, Plant Engineer; J. J. Carty, Vice President; F. B. Jewett, Vice President, President of Bell Laboratories; standing—K. W. Waterson, Assistant Vice President; O. B. Blackwell, Transmission Development Engineer; Bancroft Gherardi, Vice President and Chief Engineer

The sixteenth winter convention of the American Institute of Electrical Engineers, February 13–17, 1928, was of interest to Bell System people for several reasons. Bancroft Gherardi, Vice President and Chief Engineer of the A. T. and T. Company, was President of A. I. E. E. and presided at the general sessions. H. P. Charlesworth, A. T. & T. Plant Engineer, was chairman of the committee on meetings and papers and conducted several technical sessions. Part of one evening was given over to the presentation of the John Fritz Medal to John J. Carty, A. T. & T. Vice President, "for pioneer achievement in telephone engineering and in the development of scientific research in the telephone art." Mr. Gherardi made the presentation, and, in the course of his address, referred to Mr. Carty as "the dean of telephone engineers." Mr. Carty, accepting the honor, addressed the society on "The Ideals of the Engineer."

The outstanding event of the convention was a "joint meeting" with the British Institution of Electrical Engineers on February 16, made possible by the trans-Atlantic radio telephone service established with London the preceding year. In New York, Mr. Gherardi, Mr. Carty, and Dr. F. B. Jewett, A. T. & T. Vice President and President of the Bell Telephone Laboratories, addressed the two gatherings. The speakers in London were Mr. Archibald Page, Chief Engineer of the Central Electricity Board; Colonel Purves, Engineer in Chief of the British Post Office; and Sir Oliver Lodge. Says the contemporary account: "There was little to choose between the amplified voices of the American speakers, reaching the audience through a cluster of horns above the stage, and the British accents emanating from the same horns."

Who's Who & What's What

(Continued from page 3)

LeRoy A. Born began his Bell System career as a contract agent with the New York Telephone Company in Syracuse in 1922. Subsequent experience included commercial and sales training and sales and servicing work. In 1944 he transferred to the Public Relations Department of the A. T. & T. Co., where he is engaged in film and display work. Here he has guided and coördinated all phases of the "Telezonia" project. His interest in the educational value of motion pictures is understandable in the light of a youthful two years' experience as a teacher in a "little red school house," a B.S. degree in education *summa cum laude*, and membership in two honorary educational societies. This is Mr. Born's second contribution on the topic, his "Adventure in Telezonia" having appeared in this Magazine for Spring 1950.

A year and a half after Stuart D. Harter joined the Commercial Department of the Chesapeake and Potomac Telephone Company in Washington in 1941, he received a military leave of absence, and served with the Coast Guard during World War II in air-sea rescue operations. Returning to the C. & P. Company after the War, he served successively on the Commercial Training and Results staff, as Business Office supervisor, and as commercial manager. In 1952 he transferred to the Commercial Division of A. T. & T.'s O. & E. Department. Here he works on Customer Relations matters—which include, among other items, such things as developing an acceptance of the Telezonia program.

LeRoy A. Born

Stuart D. Harter

The New Frontier

Where is the frontier today?

Two hundred years ago it was in the back yards of the colonists on the eastern plain between the Alleghenies and the sea. Then men in fringed buckskins pushed it back over the mountains. Hunters and trappers drove the frontier across the prairies. Men and women in covered wagons rolled it over the Rockies and into the western ocean.

Then, people said, "The frontier is gone. There's nothing left to explore or develop. There are no more frontiers."

How wrong they were!

Today there is an endless frontier: the frontier of science. And telephone engineers and scientists are at work all along this modern frontier . . . in physics, in chemistry, in mathematics, in botany, in biology. In physics to improve the speed and quality of telephone communication. In chemistry to find better materials for telephone equipment. In biology and botany to find ways to protect telephone equipment against such pests as fungus and insects. They will follow any avenue of study that may lead them to improvements in your telephone service.

Behind all this there is *basic* research—the exploration of the unknown. This is a thrilling search for new ideas, for new principles and new materials.

At Bell Laboratories, as in other laboratories across America, this basic research continues year after year, helping to push back the frontiers of science, adding to the sum total of human knowledge. This basic research ultimately reaches *you* in the form of better telephone service for you and your family. Improving your telephone service is a never-ending task of the Bell System because your need for telephone service keeps on growing.

"Telephone Story" from the Telephone Hour radio program

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Bell Telephone MAGAZINE

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Keeping the Radio Relay Network in Good Order
Marion R. Hessin

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"The Service in Toledo Did Not Break Down"
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Bell Telephone *Magazine*

Summer 1953

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A Medium of Suggestion & A Record of Progress

JUDSON S. BRADLEY, *Editor. Published four times a year for the supervisory forces of the Bell System by the Public Relations Department of the*
AMERICAN TELEPHONE AND TELEGRAPH CO., *195 Broadway, New York 7, N. Y.*
CLEO F. CRAIG, *President;* S. WHITNEY LANDON, *Sec.;* ALEXANDER L. STOTT, *Treas.*

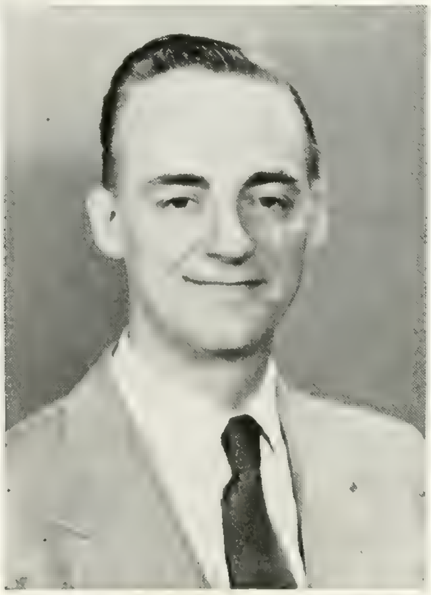
Who's Who & What's What *in This Issue*

In 1918, Mervin J. Kelley joined the research division of the Engineering Department of Western Electric, predecessor of Bell Laboratories. Assignments as director of vacuum tube development and as development director of transmission instruments and electronics preceded his appointment in 1936 as director of research. He became executive vice president in 1944 and, in the spring of 1951, President of the Laboratories.

Dr. Kelly has had wide experience not only in the research and development of telephone equipment, but also in projects for the Armed Forces. In the course of World War II, the Laboratories converted almost completely to military research and development programs, all of which were under Dr. Kelly's guidance. In recognition of his World War II contributions, he received the Presidential Certificate of Merit. In 1949 he accepted an assignment with the Atomic Energy Commission to make a critical analysis of the atomic missile research, development, and production program, and to recommend changes in organization to make it more effective. Out of this study came the Sandia Corporation. Dr. Kelly also serves as chairman of a temporary committee to advise the Secretary of Defense on certain aspects of the defense of North America, and he has acted as adviser to a number of governmental agencies on technological and scientific matters.

Dr. Kelly holds an honorary Doctorate of Engineering from the Missouri School of Mines and Metallurgy, his alma mater, and an honorary Doctor of Science degree from the University of Kentucky. He is a Fellow of the American Physical Society, the Acoustical Society of America, the Institute of Radio Engineers, and the American Institute of Electrical Engineers, and a member of the American Philosophical Society, the National Academy of Sci-

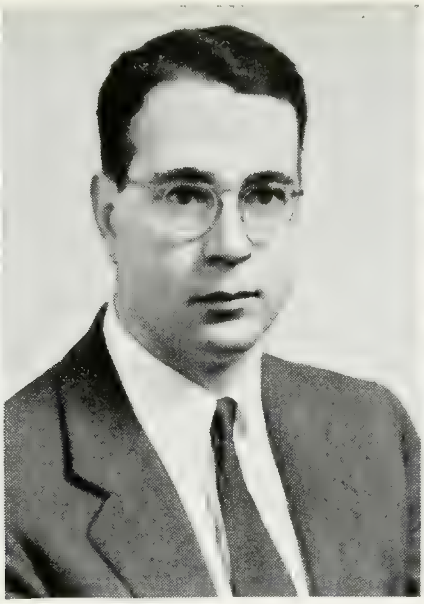
Mervin J. Kelly



Marion R. Hessin

Eugene J. McNeely

Charles J. Schaefer, Jr.



John H. Page

Donald S. Bridgman

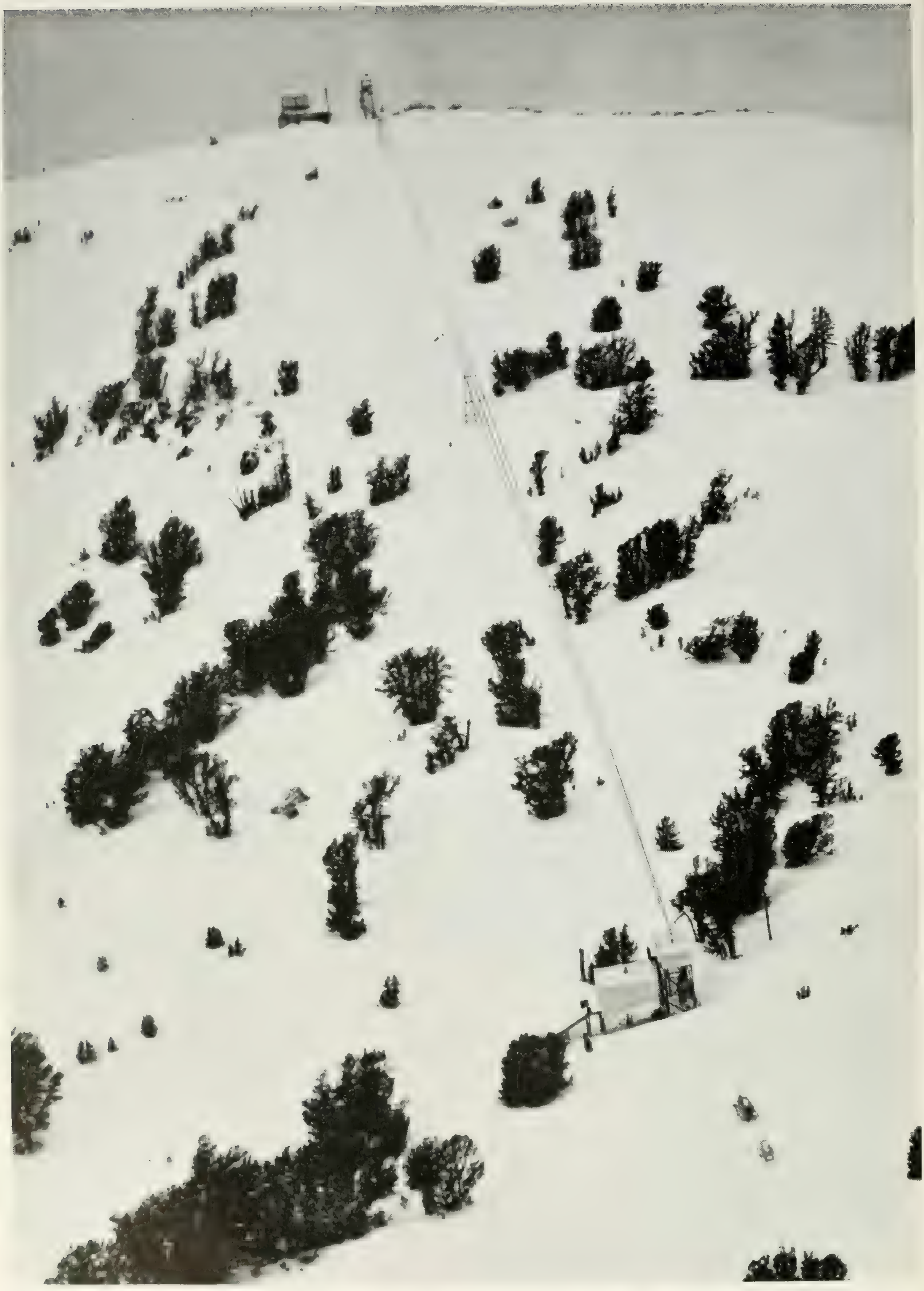
ences, and several honorary fraternities. He contributed the authoritative paper "Radar and Bell Laboratories" to this MAGAZINE for Winter 1945–46.

SAVE FOR a couple of years' absence during World War II, MARION R. HESSIN has been a member of the Long Lines Plant Department since 1928. Starting as a transmission man in Springfield, Ohio, he held posts in various cities in that State until 1946, when he transferred to New York as a staff supervisor. He was appointed successively supervisor of equipment maintenance and inside plant maintenance supervisor, and he is now supervisor of equipment methods. These responsibilities have given him an intimate acquaintance with most of the Bell System's radio relay installations and the methods and equipment which keep the radio relay network in good order.

IN THREE DECADES EUGENE J. MCNEELY progressed from student engineer with the Southwestern Bell Telephone Company to A. T. & T. Vice President. Starting with the former company in 1922, he held various craft and engineering jobs leading through posts of increasing responsibility to that of district plant superintendent in 1932, division plant superintendent in 1935, and general plant personnel supervisor in 1941. He became Area plant superintendent in 1944, and general plant manager of the Company in 1948. In that same year he moved to New York as an assistant vice president in the A. T. &. T. Personnel Relations Department. In January 1949 he was elected Vice President (Operations) of the Northwestern Bell Telephone Company, and in December of that year he was elected President of the Company. Since September 1952 he has been Vice President in charge of the Personnel Relations Department of the A. T. & T. Company.

JOINING THE Bell Telephone Company of Pennsylvania in 1914, CHARLES J. SCHAEFER JR. gained experience in both Traffic and Commercial Departments before he was appointed a special assistant in the Personnel and Public Relations Department there. In 1925 he transferred to the Personnel Relations Department of the A. T. & T. Company in New York, where he is Secretary of the Employees' Benefit Committee. The present is his third discussion of the Benefit Plan in this MAGAZINE; five years ago he contributed "The Benefit and Pension Plan Is Thirty-Five," and the BELL TELEPHONE QUAR-

(*Continued on page 124*)



Except during the short summer season, the last quarter mile of the approach to the Mt. Rose radio relay station is by aerial tramway. Note the "sno-cats" at the lower right approaching the ramp and shelter over 10 feet of snow. See page 87

The Head of the Bell Laboratories, Where the Transistor Was Invented, Describes This Revolutionary Device and Some of Its Telephone and Other Applications

The First Five Years of The Transistor

Mervin J. Kelly

FIVE YEARS AGO, in June of 1948, the Bell Telephone Laboratories announced and demonstrated publicly a semiconductor amplifier invented by John Bardeen and Walter H. Brattain, and coined for it the name TRANSISTOR. Demonstrations were given of transistor amplifiers and oscillators functioning in telephone and television repeaters and in radio receivers.

It is interesting at this fifth anniversary to recall the words used at that time by Laboratories Vice-President Ralph Bown to tell about the invention. He said in part:

"The genesis of this device is an interesting story of fundamental research and I think I ought to begin at the beginning and give it to you in orderly sequence . . .

"Scientific research is coming more and more to be recognized as a group or teamwork job. This is true not only in industrial research but to a rapidly increasing degree in academic research. In spite of this fact, there continues to be plenty of opportunity for individual work. What we have to show you today represents a fine example of brilliant individual contributions growing out of basic research in an industrial group framework . . . A considerable number of people have been working hard on this matter to bring it to the stage you will see today. Physicists, chemists, metallurgists, engineers, laboratory and shop technicians, auxiliary and office personnel—yes, even executives have played a part.

"In our laboratory the semiconductor research work is carried on by a group under the immediate guidance of William Shockley, a well-known solid-state physicist. Shockley, while examining critically the prevailing theory of electrical conduction in semiconductors, predicted that it should be possible to control the meager supply of movable electrons inside a semiconductor by influencing them with an electric field imposed from the outside without actually contacting the material. Realizing the practical implications of such a possibility, he devised some experiments to test his hypothesis, but was unable to secure positive results. The electrons seemed to get tangled up in the surface of the material and did not behave just as anticipated. This part of the problem was tackled on a theoretical basis by John Bardeen. Bardeen developed a theory of what happened at the surface which was able to explain satisfactorily many of the observed facts and which led to further experiments carried out in collaboration with Walter Brattain.

"In the course of these experiments, Bardeen and Brattain invented the device we shall show you today. We have called it the TRANSISTOR because it is a resistor or semiconductor device which can amplify electrical signals as they are transferred through it from input to output terminals."

The announcement received little public notice—one of the most restrained send-offs in recent memory, according to *Fortune* magazine—but its importance was quickly recognized by the electronics industry. It has taken nearly five years for the transistor to reach a point of development and of general recognition commensurate with its initial promise. In that time the family of transistors has grown. Other types than that first demonstrated have been invented and developed for manufacture, and the word transistor has become a generic term for semiconductor amplifiers. The transistor invented by Bardeen and Brattain we now call a "point-contact transistor." It was the only transistor to reach practical application outside the Laboratories for nearly two years.

The point-contact transistor is by now quite well known. It consists of a very small piece of germanium with two fine wires contacting its surface, separated from each other but a few thousandths of an inch. The flow of current in one of the fine points controls the flow of current in the other, somewhat as the grid in a conventional vacuum (radio) tube controls the flow of current through the tube. But here the analogy ends. The transistor is solid, there is no vacuum to maintain. It is "cold," there is no need for a heater to supply electrons. Because of this it requires very little power to be ready to operate and very little power to operate, for it is efficient. It is small and rugged. It will almost certainly have long life in service. And we are finding many ways for it to be of service.

Early Uses of the Transistor

A GREAT MAJORITY of conventional vacuum tubes are used to control or amplify small currents: in communication systems, in radio and television sets, in complicated military equipments such as radar bomb sights and computers. In such applications the transistor can be used. It does not replace the vacuum tube in the same socket and the same circuit. But with its own circuits it does the same jobs.

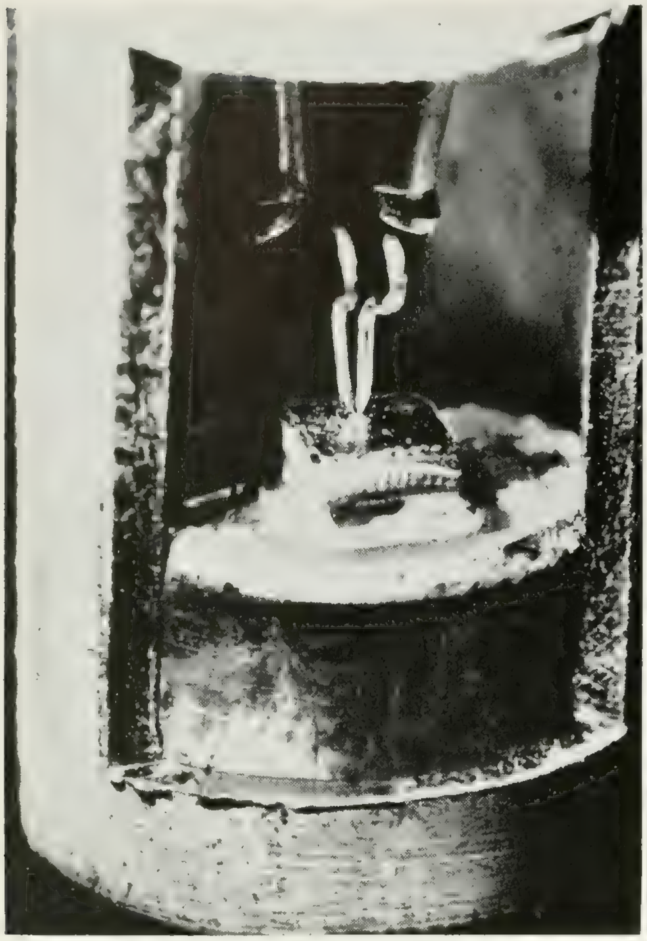
The point-contact transistor has been used in oscillators from very low frequencies to the very high frequencies of short-wave radio. It has been

With this apparatus some of the first investigations leading to the discovery of the transistor were made. Standing are John Bardeen (left) and Walter H. Brattain, inventors of the point-contact transistor. Seated is William Shockley, who directed the Laboratories research program in semiconductors

used over this wide frequency range to amplify and to control electrical signals. And it has been used, together with other very small components, to make a variety of compact electronic "packages" which perform a great many of the functions required in the modern electronic art.

With its virtues there are also some limitations: the point-contact transistor is more "noisy" in a circuit than one would like, and its ability to handle power is limited. The "noise" tends to restrict its use to the control of electrical signals rather than their generation or amplification and its power capacity limits it to relatively small currents.

The point-contact transistor, first member of the family, has been joined by a number of other types which have been announced during the five years under review. A "photo-transistor" invented by J. N. Shive has already gone into Bell System service in the "card translator" used in telephone exchanges for automatic routing in toll dialing. The photo-transistor is a device in which the flow of current through a point-contact on a



A portion of the "cartridge" casing of a point-contact transistor has been cut away to show, magnified, the two points on the germanium surface

small germanium wafer is controlled by a fine beam of light shining on a sensitive area of the germanium surface. In its telephone exchange use it conserves both space and power.

The Junction Transistor

Early in the study of transistors, it was predicted by Shockley, on the basis of theory, that a "junction" transistor, different in structure, would have useful properties. The idea was to have in a germanium crystal a very thin region of one electrical type separating the two adjoining end regions of different electrical type. The two boundaries or "junctions" between the thin region and the two end regions were to serve the same functions as the two points in the point-contact device. The thing itself was simple. Shockley's theory could predict the performance to be expected. The problem was to find ways to make it.

With metallurgists and chemists and physicists working together, such units were made. A thin layer with the necessary electrical property was produced in a germanium crystal without destroying the otherwise essentially perfect regularity of the crystal. Junction transistors produced in this way not only behave as the theory says they should; they have other remarkable properties as well. They are not "noisy." In fact, they compete favorably in respect to "noise" with the very best vacuum tubes. They are remarkably efficient, closely approaching the maximum possible. But perhaps most interesting, they are ready to operate with as little as one-millionth the power necessary to keep an ordinary vacuum tube, with its hot cathode, in the ready condition.

For telephone uses the significance of this extremely low power drain is not hard to see. The sound power in a telephone receiver for normal conversation is comparable to the power needed by the transistor to keep it in working readiness. Conventional vacuum tubes, requiring many, many times this standby power, are used of course for special needs and in all long distance circuits where many conversations may be amplified at the same time. But they are economically unjustified in the local telephone plant or in the telephone instrument itself. With the junction transistor this is no longer the case: its minute power requirements remove that economic limitation and make it available for extensive telephone use.

"Single Crystals" of a Very Pure Material

We have passed over lightly a matter of major importance in the history of all transistors: the "single" crystal and the extreme purity required of transistor materials. The earliest transistors were made of germanium purified and allowed to solidify by conventional metallurgical and chemical techniques. The germanium usually solidified from the molten condition as a random collection of smaller crystals. Transistors from this polycrystalline germanium showed erratic performance from one unit to the next. The problem was to get the germanium into one big "perfect crystal." Our chemists and metallurgists did this. In fact, they have found several ways to make "single" crystals. This source of difficulty is now well past—all transistors are now made of "single crystal" germanium in which the successive layers of atoms are carefully ordered, one upon the other.

The question of purity has also been vital. Transistor action depends on the presence in the germanium crystal of a very few "foreign" atoms—perhaps one foreign atom for each 100,000,000 germanium atoms—and their arrangement in the crystal must be controlled. This means that we must purify the germanium to an even higher degree of purity—then introduce the known and carefully controlled "impurity" where we want it. The germanium so prepared may very well be the purest material in existence.

Some Telephone Uses

In the Laboratories many possibilities are now being explored. Will telephone instruments of the future use transistors directly? Very likely, and there is active work in progress. Will transistors be used in the complicated exchanges where the telephone user is automatically connected to the party he is calling? Very likely, and very promising. Promising in terms of what can be done, speed of operation, power and space

The ease with which electrons move in a semiconductor crystal is an important fundamental measurement here being performed by Gerald L. Pearson (standing) and J. R. Haynes needed, as well as probable cost and reliability in service. In our automatic telephone exchanges today there are substantially no operators. But even with mechanization, electronics has had only a small part to play in the evolution of complex switching systems such as No. 4 and No. 5 crossbar. Transistors, as well as other solid-state devices, with their capability of high speed operation, their small bulk and low power requirements, will find natural application in switching apparatus.

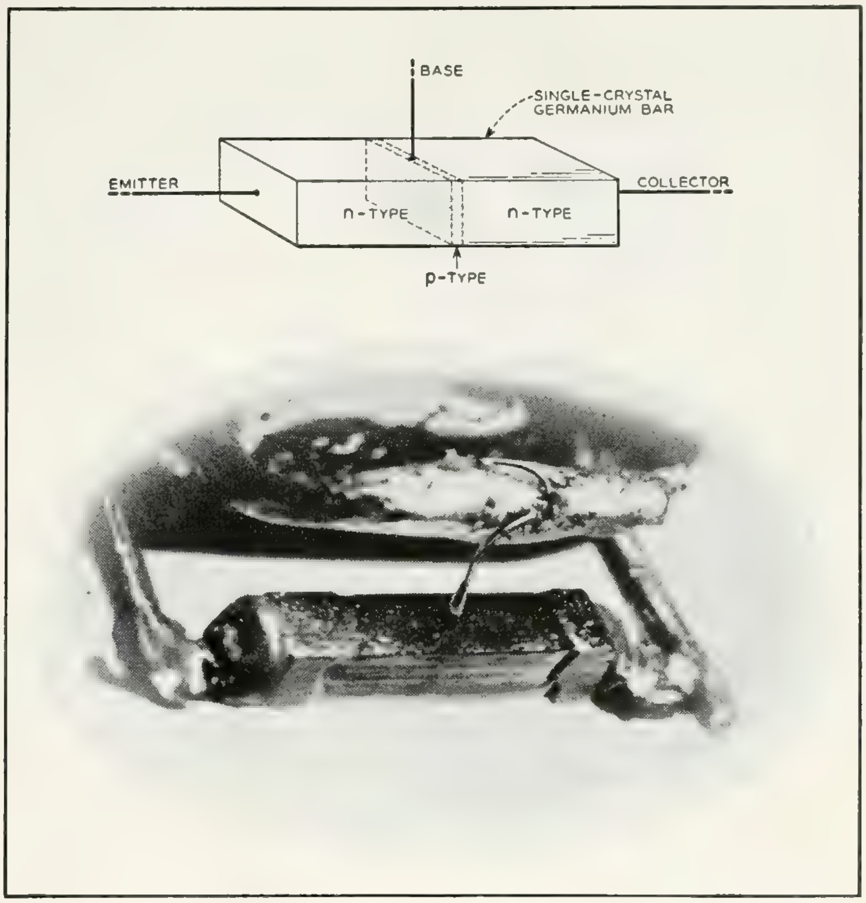
Will the transistor have a role to play in distributing television pictures in communities or improving long distance communication? It will have a role to play in both. It may well be that broadband circuits for long distance uses will take new form through lower circuit mile costs that the transistor will make possible. New opportunities for extensive distribution of television in urban areas are possible. The transistor may allow the use of our carrier methods over shorter distances and lightly loaded lines. Its use in exchange areas and on rural lines cannot be excluded. A recently announced Laboratories development, the "tetrode" transistor of R. L.

The first commercial application of the transistor and the phototransistor was in this card translator equipment. The card translator was initially installed in 1952 as an adjunct to the complex telephone switching system used in nation-wide operator toll dialing

Wallace, Jr., is an important step.

The Tetrode Transistor

An initial limitation of the junction transistor lay in its inability to handle the higher frequencies. This limitation for many uses is now largely removed by the invention of the tetrode transistor, which, however, retains the other virtues of its predecessor. We cannot foresee all of its ultimate uses, but already it has been used in a high-performance amplifier of minute dimensions. The entire amplifier is housed in a tiny "coaxial cable" about one-eighth inch in diameter and one and a half inches long. It requires no more power than its small size suggests, and it can readily satisfy the severe requirements of television transmission.



In this magnified view, the fine wire on the top surface of an experimental junction transistor is seen connected to a thin central section of the germanium bar. The germanium crystal itself is continuous but the electrical properties of the two end portions differ from those of the central section

Research, invention, development, and application have grown at a hearty pace. But the field is still very new, and as the studies progress and understanding increases so also does the prospect. Before the first announcement, five years ago, when the new physical phenomena were observed and radically new electronic devices invented, it was evident to us that we were seeing the beginnings of an era in electronics technology—of significance not only to the telephone system but also to the military services and to industry and civilian use generally.

How did we open the door to this new era?

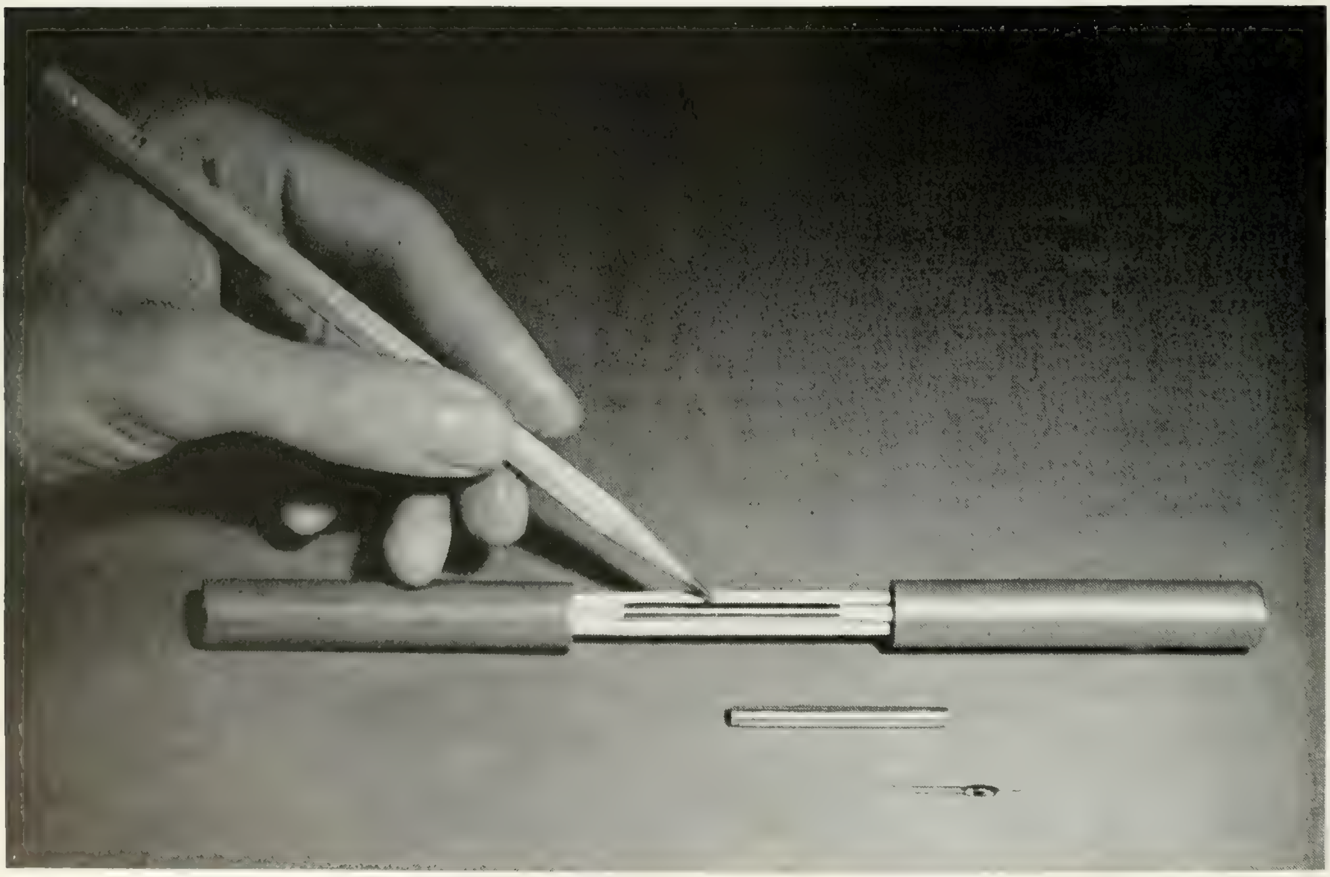
Organized Creative Technology

I have had occasion before to stress the value of continuity in the procedures from the initial steps of forward-looking basic research to the terminal operations of manufacture and use. I speak of them as the single entity: "organized creative technology." No example illustrates its meaning more dramatically than the story of the transistor.

I have already emphasized the

comprehensive work of the research group in studying the mechanisms of conduction of electricity in solid semiconductors. Physicists, both experimenters and theorists, metallurgists, chemists—were joined together in a common effort to gain understanding in a field of relevance and potential importance to communication technology. The scientists published the results of their findings and frankly discussed the new phenomena with their peers.

In accord with our policy of concentrating the efforts of our research scientists on research, we immediately formed a fundamental development group under J. A. Morton. This group was closely associated with research to acquire that body of technological knowledge essential to the development and design of transistors for the many specific communications applications that would certainly follow. The fundamental development group was composed of men of electronics, skilled in the development of new electronic devices for communication and military uses. In the beginning, their interests and activities were not distinguishable from those of the research group. Their first task was to learn, and this was quickly done. However, their ultimate role was never in question. They were to apply the new knowledge from research and to supplement it—in a more specific way—to create new devices for our systems development groups to utilize in creating new systems both for the Bell System and for the military services that would find application because of economic or fundamental advantages.



In the foreground is a "tetrode" transistor. The small cylinder houses a complete amplifier. Shown also is the amplifier in place in a possible cable

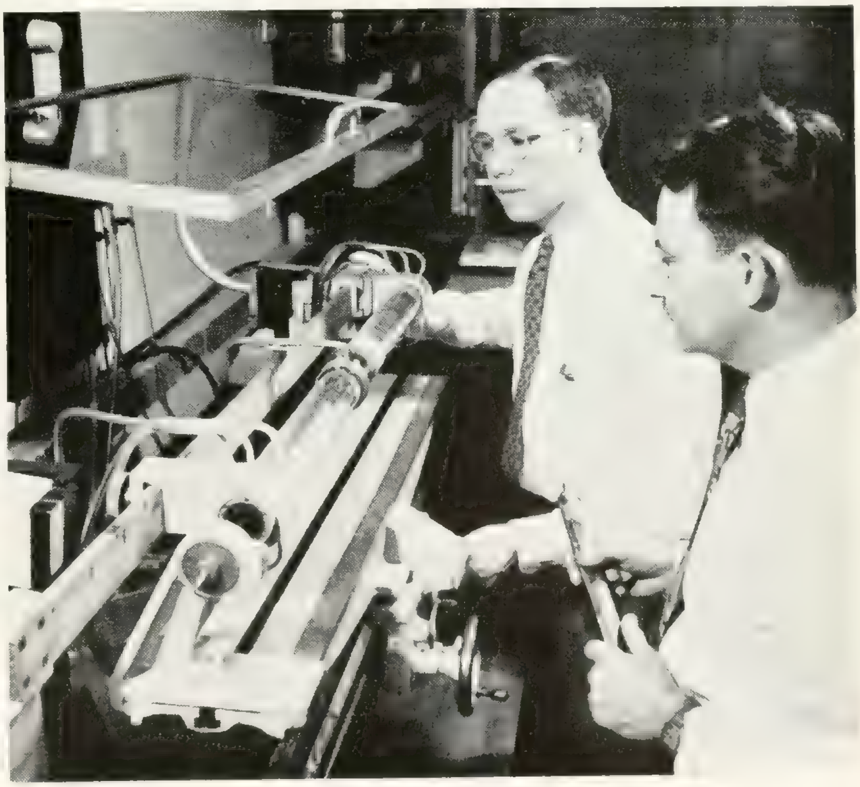
Contributions to new knowledge were made and, as applications of transistors became more and more clear, the group turned its attentions to the development of specific designs which would be required on a large scale. They have also interested themselves in such problems as the factors controlling the band width of amplification, the "noise figure," the amount of amplification possible per stage, basic materials, processing, and structure studies essential for controlled development and design of transistors for a variety of specific functions.

The link with research was strong and stimulating. A linkage with the systems development people, the likely users, was also encouraged. Jointly with the user, operating characteristics of transistors were established, units were constructed for trial, and pre-production methods were worked out.

Following the pattern used for electron tubes, the final stages of design for manufacture are carried out by the Laboratories group located at the Western

Above: The making of composite crystals for junction transistors was a problem for chemists. Gordon K. Teal (left) and Morgan Sparks are here studying one of the early units

Below: Ingenious new metallurgical techniques have played an important part in the purification of germanium. Using the "zone refining" method here being demonstrated by its inventor W. G. Pfann, germanium of extreme purity is produced. J. H. Scaff is holding a large germanium "single crystal" made by this process.



Electric Company factory at Allentown, Pennsylvania. Because of the novel processes and technology used in making transistors, Western Electric sent its engineers at an early stage into laboratories work both at Murray Hill and at Allentown. Twelve different transistor types have so far been through this development sequence and have been put into pilot plant production by Western at Allentown. Meanwhile, Western has made ready at Laureldale, Pennsylvania, a production plant for military transistor manufacture. Tens of thousands of transistors of all types have been produced by Western and supplied not only for Bell System and military uses but also to various other developers and manufacturers of military equipment.

The course of development is one we well know: severe requirements to meet high standards, unsuspected difficulties, failures—and success. The pattern continues, and in taking stock we can say that while there are probably as many problems ahead as have already been solved, tran-

Above: When the feasibility of a new device has been demonstrated, its development is taken over by an Apparatus Development department. J. R. Wilson (right) and J. A. Morton head the Electronics Apparatus Development Department which has brought the transistor to its present state. Below: The tetrode transistor is now a joint undertaking between research, R. L. Wallace, Jr. (left), and development, W. J. Pietenpol

sistors are built on an unusually firm scientific foundation; and they have been developed to a status of flexible utility, reproducibility, and reliability. They are now made of material of crystalline perfection and remarkable purity, produced through the ingenious processes of our chemists and metallurgists. Their service life in proper use we expect to be very long. They are "reproducible" in the same sense that vacuum tubes are reproducible and as the art of their manufacture matures, they should be inexpensive.

Apparatus Components for Use with Transistors

A NEW DEVICE or a new invention stimulates and frequently demands other new devices and inventions for its proper use. This is particularly true of the transistor. Its circuit technology, its efficiency and low power requirements we have already mentioned. Operating voltages in most applications are remarkably low, perhaps $\frac{1}{20}$th the voltage required by ordinary vacuum tubes—only a fraction of the voltage readily available in telephone central offices.

Here in the Western Electric Company Allentown Plant a battery of machines is in operation for cutting single crystals of germanium into very small units to be used in transistors

At these low voltages, capacitors will be made and are now under development which are as much smaller than ordinary capacitors as the transistor itself is smaller than a vacuum tube. In telephone communication uses, with low voltages and low currents, coils and transformers may be correspondingly "miniaturized." A whole series of new miniature components is now being developed in the Laboratories for use with the transistor—to take full advantage of its modest requirements.

Military Uses

Bell Laboratories activity in transistors is primarily in two directions: to serve the needs of the Bell System and to contribute to the military strength of the country. It was recognized at the outset that secrecy would severely hamper both of these objectives by restricting the free and rapid flow of ideas and delaying broad use of the new technology in military applications. A policy was adopted to make transistor information easily available to those with a legitimate need for it. This policy has been implemented both through our usual practice of early publication of scientific work and through patent licenses offered by the Western Electric Company.

To expedite the availability of information, there was held at the Murray Hill laboratory in September 1951, with the coöperation of the Military Services, a week-long symposium on the characteristics and applications of the transistor. Some 300 engineers from our own and Western European countries attended. Thirty-five papers by members of our staff were presented, and later issued as an 800 page volume.

In April of 1952, a symposium on transistor technology—devoted to the dissemination of "know how"—for licensees of the Western Electric Company was held at Murray Hill and at the Western Electric Company plant in Allentown. Representatives from 26 domestic and 14 foreign organizations attended intensive sessions lasting eight days. The material presented, cov-

Silicon, another important semiconductor, is purified and grown in "single crystal" form in this apparatus by E. Buehler ering the entire range of technology, was subsequently published as a two-volume classified work. Later still, in the summer of 1952, a short course for university professors was held, attended by professors from over thirty institutions. The result has been widespread development both in university research and in the industry.

The "photo-transistor," "point-contact," "junction" and other transistors for special Bell System and military uses are responsibilities of development engineers A. E. Anderson (left), J. N. Shive (center) and R. M. Ryder

Specific military applications of the transistor must, of course, remain classified, but an appreciation of its promise in military use can still be had, as the following example shows. In World War II, radar played a very important part. Today, aircraft bomb sights are built around radar. Detection of targets, range, and bearing all come from radar. This information feeds into a "computer" which quickly determines the proper release point, taking into account other information as well: aircraft and wind velocity, altitude, and the flight characteristics of the missile. The radar and computer make a highly intricate electronic system, using hundreds of vacuum tubes and considerable power, and occupying much valuable space. Perhaps 80 per cent of the vacuum tube functions may equally well be performed by transistors, with savings in space, weight, and power alone of major significance to our air forces.

In many other parts of our complex military technology there are uses, large and small, for transistors. Reliability, small size and weight, low power consumption—these are goals of the designers of military equipment. The transistor takes us a large step towards these goals.

Future Developments

TODAY'S ELECTRONICS INDUSTRY is built largely on an invention of Lee deForest in 1907: the three-element vacuum tube. The first commercial use of the vacuum tube in transcontinental telephony was in 1915, eight years later. The vacuum tube had extensive development for military purposes in World War I, and was used in telephone carrier in 1918.

The transistor is very young and already it is making its mark. Its impact will be felt not only in replacement of vacuum tubes for reasons of

Miniature apparatus components have been developed to work with the transistor. The transistor itself is small compared to the smallest vacuum tubes. Resistors, capacitors, transformers, inductors are all correspondingly smaller than their counterparts used with vacuum tubes

economy. It will make completely new fields for itself as it begins to do work where vacuum tubes have so far been excluded. Ultimately we shall see transistors at work automatically routing and connecting telephone calls through exchanges, doing accounting and computing, and performing in other so-called "electronic brains." They are now appearing in hearing aids, and we shall soon see them in home radio and television sets.

The transistor, with all its promise, will come into large-scale use in the Bell System only gradually. Other fields of application—military electronic systems, home entertainment, special services—may well have the larger initial uses. For in these fields, particularly the military, it will now be possible to do things, urgent things, with transistors which have heretofore been prohibited by the size, weight, power requirements, or lack of reliability of alternative methods.

This is not the case in most telephone applications. The Bell System plant is a carefully integrated complex of instruments, transmission paths, and interconnecting mechanisms which has been evolved over the years to provide service at low cost and with great reliability. The transistor will emerge as an important part of our telephone technology only as rapidly as we gain sound experience with its practical ability to meet the requirements of the present system. New services and new methods of providing present services are being examined continuously from a systems standpoint. The transistor gives us a powerful new tool in these studies.

A new technology is growing around the transistor; a new industry will grow with it. Bell Laboratories, continuing in the forefront, will realize for the Bell System and the military services the promise of these five years.

New Methods Have Been Developed for Maintenance of 230 Radio Relay Stations, in Varied Locations throughout The Length and Breadth of This Country

Keeping the Radio Relay Network in Good Order

Marion R. Hessin

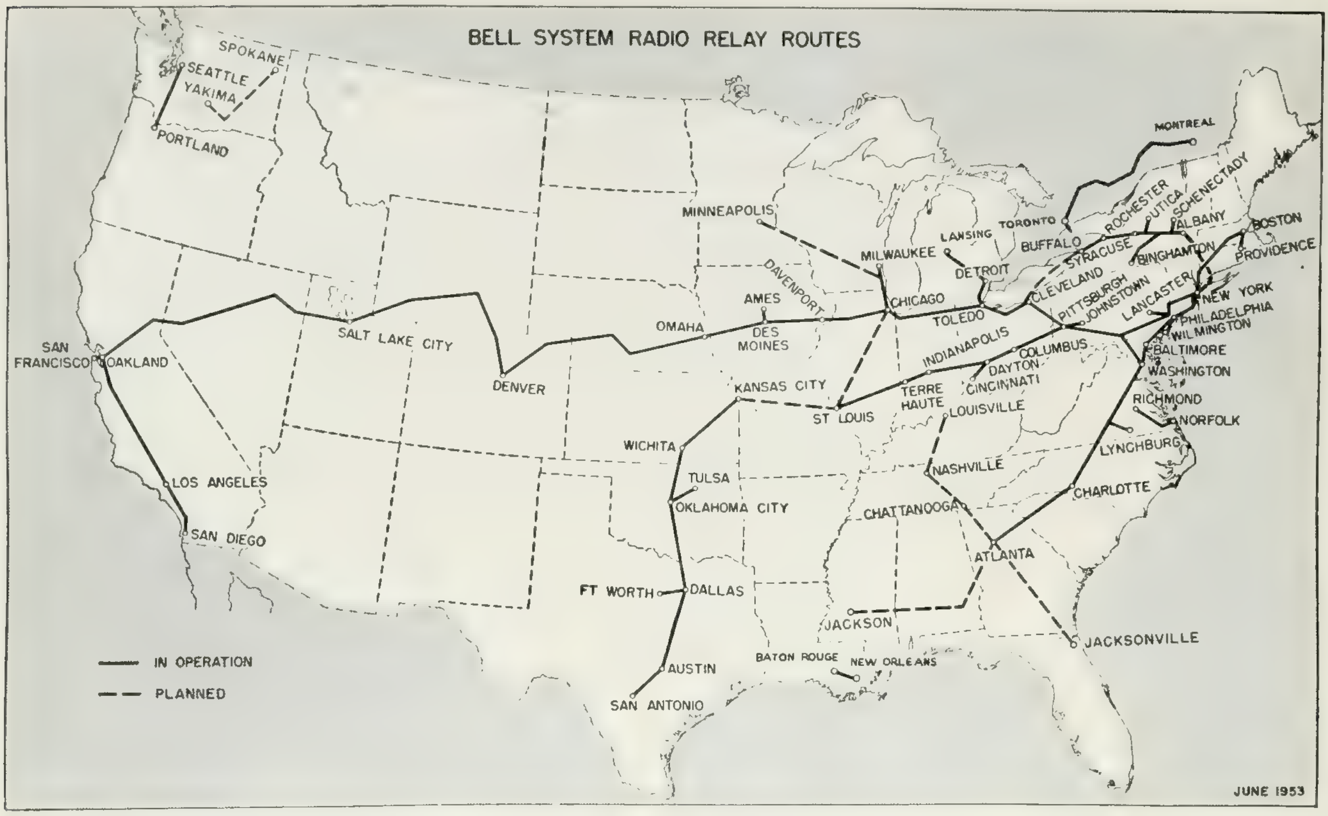
Were you one of the many thousands who enjoyed the Rose Bowl football game as brought to you via television from Pasadena last January 1? Just about an hour before the start of the game, a vacuum tube failed in one of the Bell System's radio relay stations high in the mountains, and instantly broke the circuit which was to carry the game to television broadcasting stations throughout the country.

Despite the tube failure, you were able to watch the game because several things then happened in rapid succession. A light flashed on instantly in an alarm center in a telephone company building not many miles away, showing not only that something was wrong at that particular relay station but exactly *what* was wrong. A maintenance man was dispatched immediately by car to the station, where he replaced the tube—thus restoring the circuit to operation in ample time for the game.

This was the indicated course of action under those particular circumstances. Had other conditions prevailed, a different move would have followed: a quick shift to another radio relay circuit, for instance. Indeed, facilities are now being provided along the main radio relay routes for immediate automatic switching from one channel to another in case of need.

There was nothing spectacular about the incident—unless perhaps it was the mountain scenery. But it involved manpower, equipment, and skill—all of which the Bell System had provided in advance against such an occasional mishap.

This example is cited because, as the System's radio relay network grows, month by month, more Americans receive long distance telephone calls and more television broadcasting stations receive live programs from distant points by means of this new



communications medium. Already, there are some 230 radio relay points on these routes which crisscross the countryside for more than 8,000 miles. For if these calls and programs reach their destination in good shape, as indeed they do, it is evident that a new and sizeable maintenance task is being encountered—and accomplished.

Each radio relay station on this vast network is a small, independent unit, usually situated at some distance from the centers of normal telephone company activity. On the average, each station is some 30 miles from the neighboring relay stations to and from which television programs and hundreds of telephone conversations are transmitted via concentrated beams of radio energy. Both the radio equipment and the power plant in these stations are designed to be operated continuously and without personnel in attendance.

Here, then, is the maintenance problem: to insure the proper functioning of a certain amount of radio transmitting and receiving equipment, plus the power plant necessary for its operation—all to be found at some isolated spot on farmland, in forests, on the plains, on mountainsides, or even in the desert. Operate the station must, or the program and the message will not get through. Yet it is miles down the road—or along a telephone line—from the nearest center where telephone people are to be found. Nonetheless, as the reader knows, that call or program does get to its destination by radio relay.

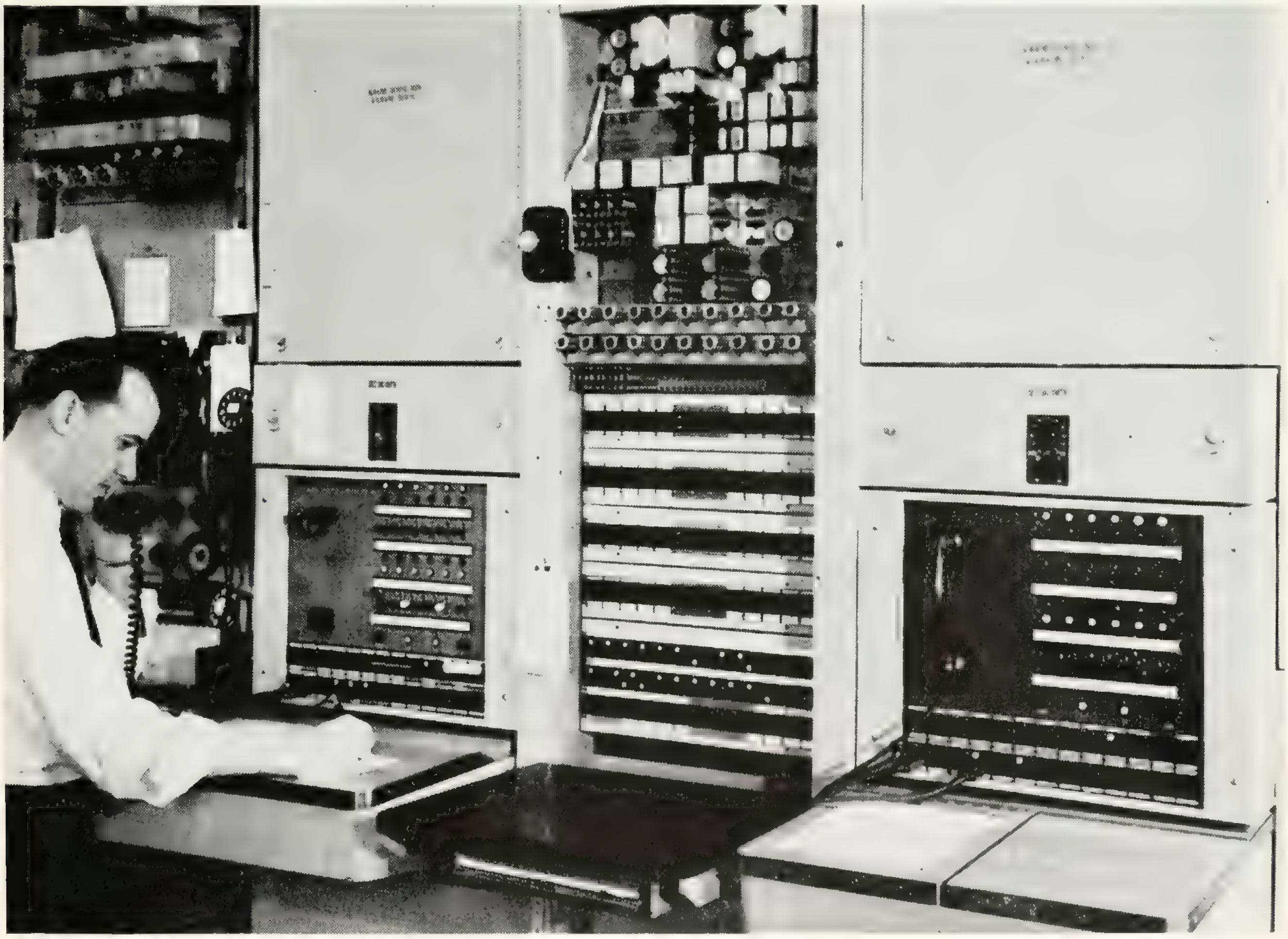
Organization for Maintenance

The problem is handled this way: An established telephone office, where people are on duty day and night, is selected for its strategic location in relation to several—say, three to five—radio relay stations, and is designated as the maintenance center for those stations. In practice, this means that the maintenance center is within about 75 miles or a couple of hours' auto travel time of the relay stations assigned to it for observation. Where two radio routes cross, incidentally, it may even be possible to maintain as many as ten relay stations without increasing the travel time from the maintenance center to the most remote unit in the groups.

Each maintenance center is staffed with trained craftsmen, who carry out their responsibilities by means of periodic routine inspections at the relay station and by being on call in case of sudden trouble.

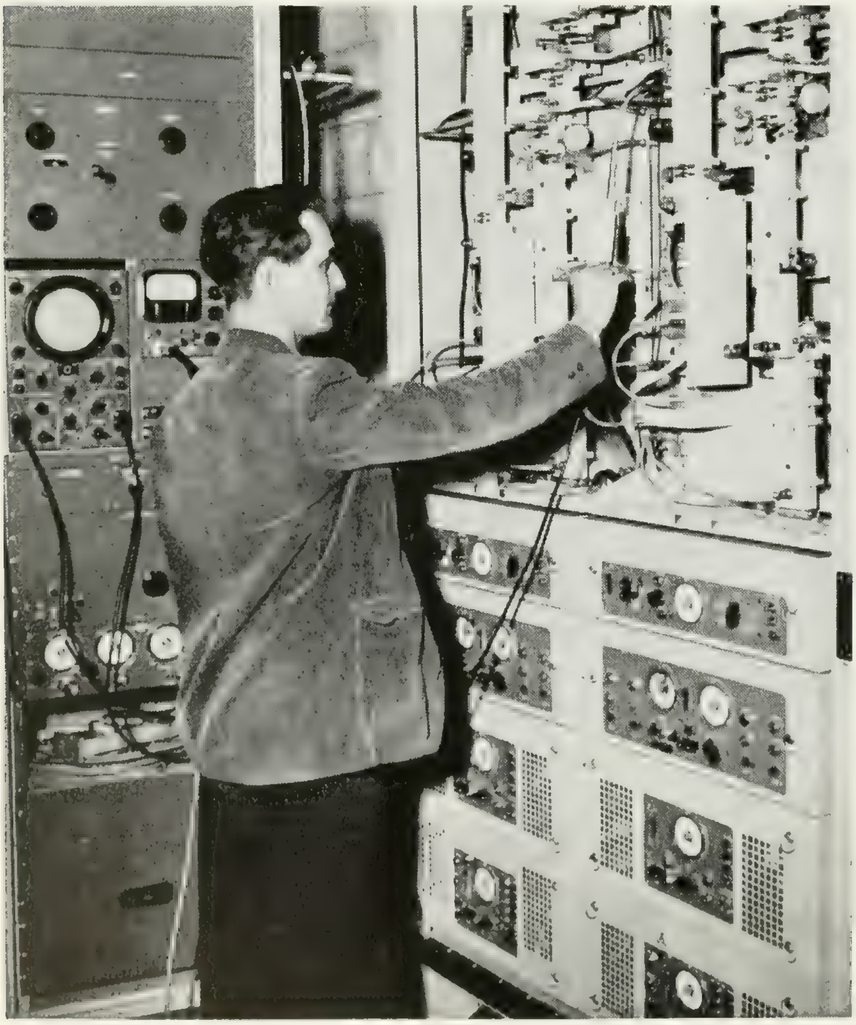
Now, each relay point may be unattended but it is not, so to speak, unprotected. A remarkable automatic alarm system is installed in each relay station which can register scores of different situations, indicating normal operation as well as some irregular condition. Thus, if a tube fails, commercial power is cut off, a relay balks, the station door is opened, or other difficulties arise, the alarm system will instantly flash news of the event to an "alarm center," where an ingenious arrangement of lights indicates the location and nature of the trouble.

Alarm centers are established in certain maintenance centers—usually one alarm center to each three of the latter. The alarm system is capable of handling the troubles reported by as many as 12 radio relay stations on the network.



Signal bays at an alarm center. Here a light flashes and a bell rings to notify an attendant of some irregularity at a radio relay station within his territory

Actually, the alarm system is so arranged that it is possible for those at the alarm center, by throwing keys and pushing buttons, to perform by means of remote control any one of ninety different operations within the station sending the alarm. However, the alarm received may indicate a condition that only a maintenance man on the scene can solve. Under such circumstances, those at the alarm center will promptly get in touch with the force at the nearest maintenance center, which will dispatch a man to the point in difficulty. Meanwhile, alternative facilities will be handling whatever messages might have been subject to interruption.

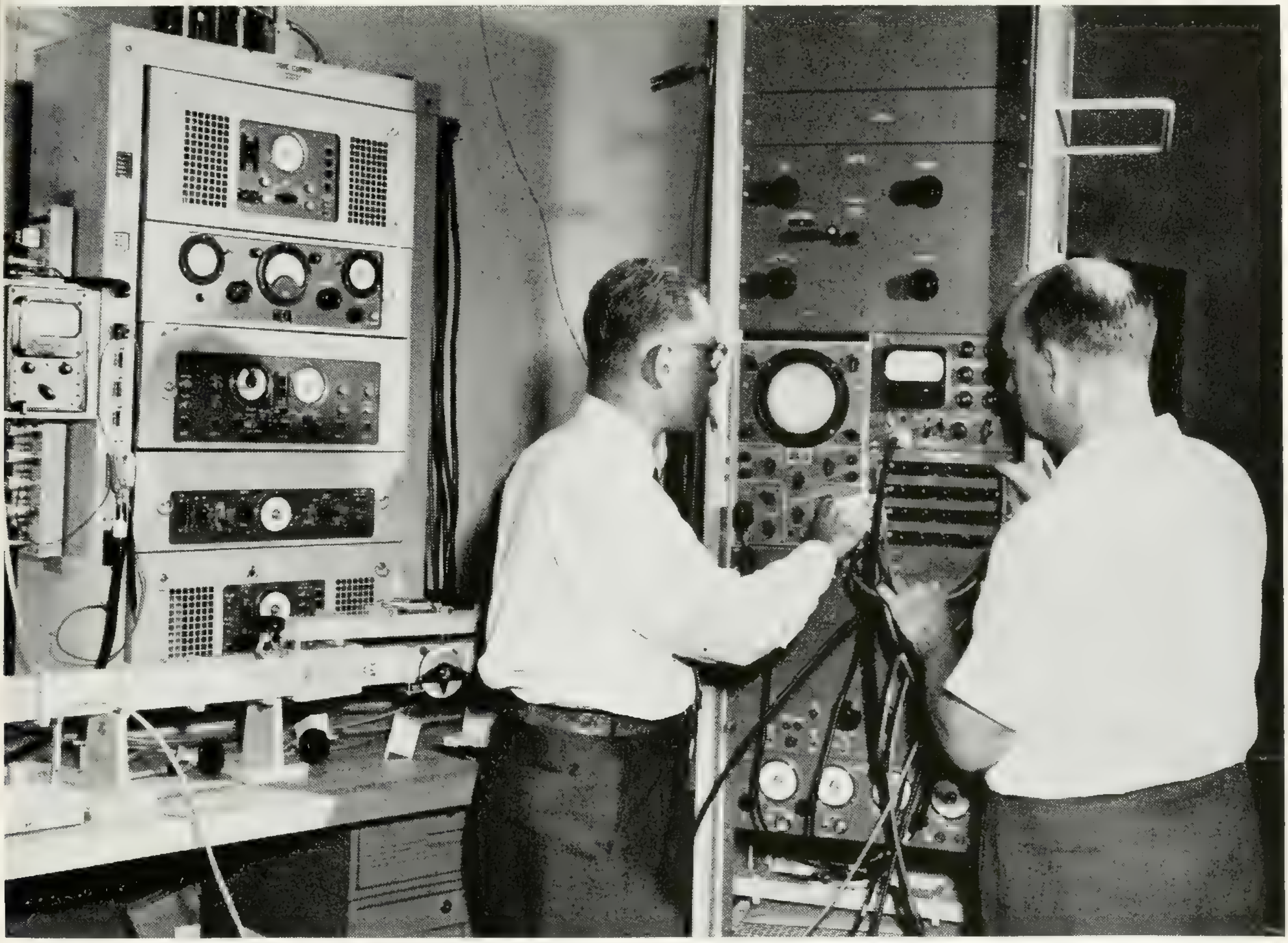


This man is using testing equipment to adjust equipment in a radio relay station

A further duty of those at the alarm center is to report such incidents to still another telephone company office—the "control office," which is responsible for the over-all continuity of the television program or telephone service. Such offices are found at a few widely separated key cities where various radio relay routes come together, and have the responsibility of directing circuit rearrangements or rerouting if the interruption cannot be remedied quickly at the relay station itself.

At each relay station a certain amount of testing apparatus is available and, as a result, a high percentage of both preventive and repair work can be handled on the spot. Some troubles can be cleared by the replacement of, say, a single tube, but others may require the replacement of an entire sub-assembly of equipment. Consequently, spare parts and sub-assemblies of apparatus for such replacement are kept at each relay station. These can usually be installed in about fifteen minutes after a maintenance man has reached the relay station. Defective pieces of equipment which have been removed from service are returned to the maintenance center, where the necessary apparatus for repair and adjustment is available.

Some of the radio re-

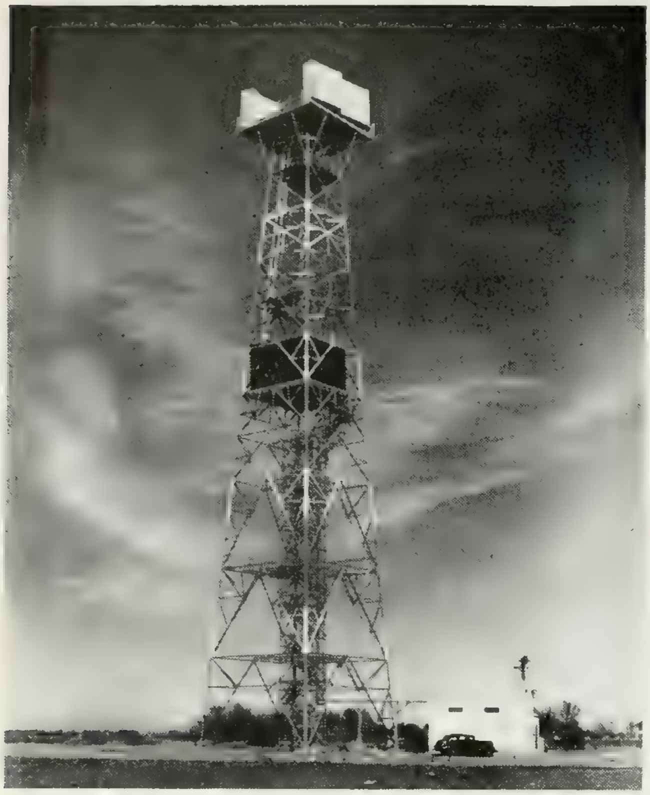


Equipment men in a maintenance center are testing a radio amplifier

lay stations are so remote that no commercial electric power is available to them. Then maintenance includes responsibility for continuous operation of the primary power plant as well as the emergency generator.

There are, too, the unusual problems involved, for example, in maintaining equipment often installed on a temporary basis, for establishment of a microwave link to handle some special event or in order to hurry network television into an area which is eager to see "live" programs from afar. News stories about these matters are full of the excitement and value of the occasion. But it is clear that a radio relay station set up to handle a single football game, or a political speech—hence one which includes apparatus lined up under pressure and not equipped with as complete testing facilities as are ordinarily available at a regular point on the network—offers special maintenance problems. Nonetheless, when General Eisenhower launched his campaign by speaking from Abilene, the equipment was ready for him. And even if the trio of stations set up temporarily (pending a permanent installation) to speed network service from Oklahoma City to Tulsa were incomplete in some details, the equipment performed without fault.

Again, there are what might be termed normal maintenance difficulties. A score or more of radio relay stations, such as the very tall structure at Valparaiso, Indiana, house



"Cabin in the sky": on the route between Omaha and Denver several of these towers support transmitting and receiving equipment about 100 feet above ground

radio equipment and regular power plant half way up the tower. In the case cited, all apparatus must be hauled up by block and tackle, and the men occupied with maintenance must climb 100 feet by an inside stairway to the scene of their work.

And there are, of course, the really odd problems. The radio relay station on Suwanee Mountain, just north of Atlanta, for example, has intruded on the home of a flock of buzzards. The buzzards, it develops, are not happy with this invasion of science into their midst—but they are making the best of things by perching on the top of whatever radio antenna horns are available. Almost as many efforts to dislodge buzzards have been undertaken as were devoted some years ago to the problem of crows sitting on telephone wires. Physical efforts to dislodge them have left a good deal to be desired in effectiveness, and the most recent buzzard "shooer-awayer" is a sort of Rube Goldberg noise-maker.

Finding the Trouble

When the pattern of lights in an alarm center indicates to the attendant that there is trouble at a radio relay station, he takes immediate action to determine the exact nature of the difficulty, and then alerts the maintenance center responsible for the station in trouble, so that remedial measures can be taken. When the alarm shows a transmission path failure, the maintenance center notifies the control office—in those cases where the automatic protective facilities fail to function for any reason—in order that service may be rerouted to another path.

Frequently the alarms show conditions which have not caused actual service failure but which may call for adjustment of the radio or power equipment to prevent a failure or to avoid adverse effect on the conversations or TV programs being transmitted. Above all, the maintenance of radio relay equipment involves the care of electronic tubes. Actually, about 85 per cent of the troubles experienced on this relatively new type of facility have related to tubes, and it is immediately apparent that the reliability of the radio relay service is largely dependent on the proper testing of those tubes.

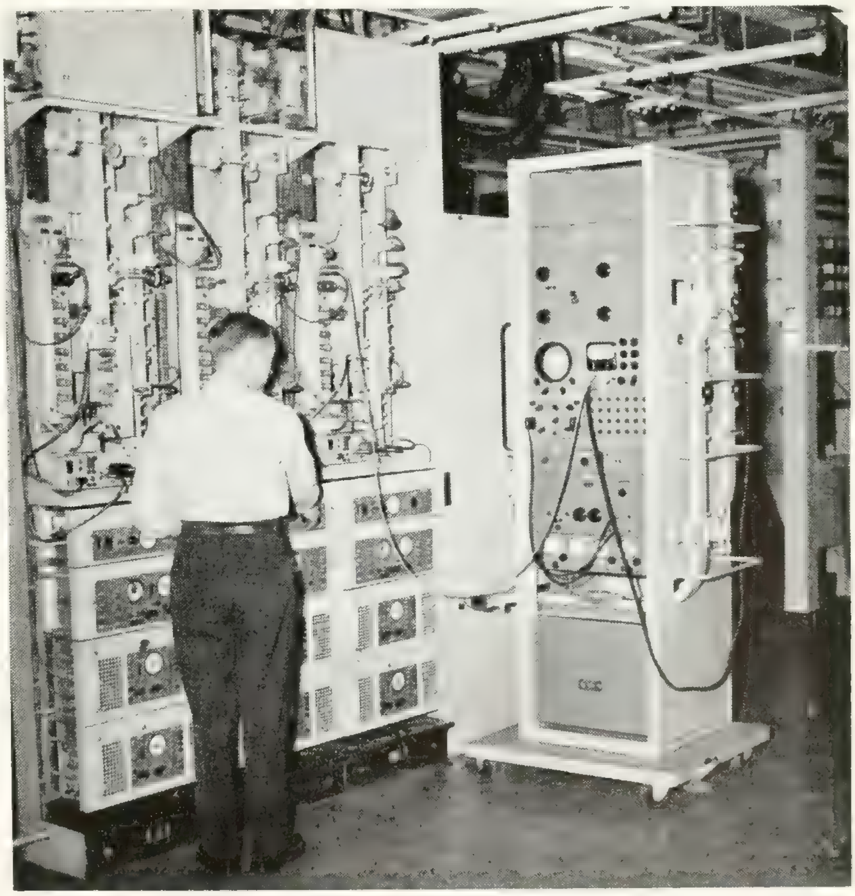
A remarkable new tube, which made microwave radio relay operation possible, was developed by the Bell Laboratories, but its relatively short service life offered the maintenance forces real difficulty. Now, as a result of continuing developmental work, the tube has been re-designed both mechanically and electrically, with the result that the newer model is far hardier—and there may even be some gains in transmission performance. Already, a program is under way through which, it is expected, all the old tubes will have been replaced in less than a year's time and, with the new tube in use, it is believed that failures will be reduced by more than 50 per cent.

When the maintenance man arrives at a relay station, he first gets in touch with the alarm center to be sure that the equipment in difficulty is idle and therefore is available for test. In clearing a case of trouble, a series of meters can be connected rather quickly to strategic points in the radio equipment. This permits the maintenance man to ascertain the condition of the numerous tubes as well as the condition of other parts of the apparatus. Perhaps a vacuum tube substitution may put the unit back into working order. Or if a condensor or a resistor has failed, it becomes necessary to substitute one of the spare pieces of apparatus available in the station for just such an emergency. Once the replacement of tube or unit has been made, the entire radio apparatus must be checked to determine that the equipment is able to transmit a television program or telephone conversation of satisfactory quality. Finally, when the trouble has been cleared, the maintenance man notifies the alarm center and the control office that all is well. And then he returns to the maintenance center.

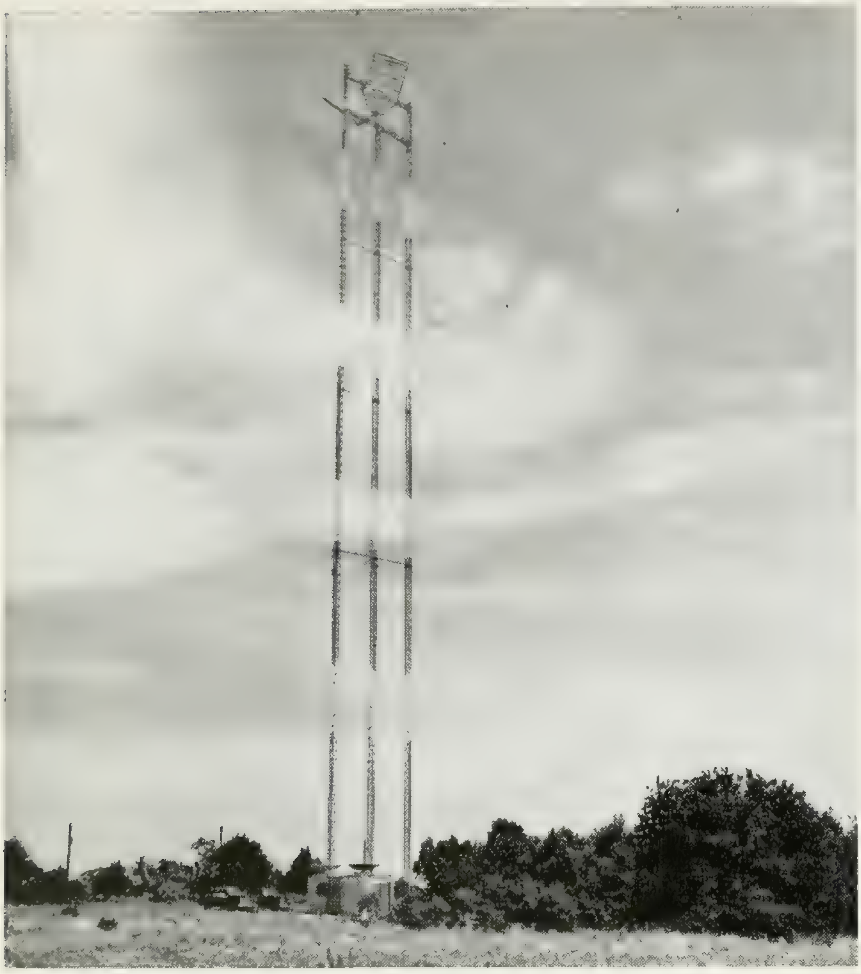
On Location

The actual trouble clear-up episode doesn't always turn out so neatly, for Mother Nature sometimes takes a part in it.

Being located throughout this country, radio relay stations are found in all imaginable types of terrain. A unit of the Bell System network which is in difficulty may be perched on a hill-top in Pennsylvania, sitting on the salt flats in Utah, or overlooking the Golden Gate in San Francisco. Maintenance men must be equipped to reach all these points at every season



End of the line: adjusting a channel at a terminal in New York City



A semi-permanent antenna support. The bowl-shaped objects on the roof of the building beneath the uprights are "dish" antennas, the rectangular objects at the top are metallic "mirrors," and the signals—conversations or television program—are "bounced" between the two en route to and from the adjoining towers of the radio relay system

and at any hour, sometimes by driving along all-weather highways, and on occasion over the more difficult access roads leading to stations which may be situated at points remote from more traveled roads.

Ordinarily a passenger car does the trick, but in the mountains and over rougher terrain at the season of mud and snow a four-wheel-drive jeep offers many advantages. When stations at inaccessible spots are to be reached at the time deep snow makes both highway and approach roads impassable, specially designed vehicles, called Sno-cat and Sno-shu, are used. These vehicles utilize caterpillar tread, so that the maintenance man finds it possible to travel over snow.

The writer recalls one such occasion when he and several companions bent on observing conditions at radio relay stations left the maintenance center at Elko, Nevada, on a cold overcast day, with a couple of feet of snow under foot. The overcast sky kept the light intensity very low and the horizon seemed to melt into the sky. Nonetheless, the going was fairly easy for a few miles. Then an "overhang" of snow close by our trail caused us some concern lest we drive the Sno-cat out on to such a snow formation and break through for a long fall. In some places it was necessary for one man to walk ahead of the Sno-cat on snowshoes to be certain that there was solid mountain to drive on. Elsewhere, the side hill became too steep because of fallen or drifted snow, and it was necessary to shovel out the high side to prevent the "cat" from rolling over.

The trip to the radio relay station atop Mt. Rose, Nevada, is beautiful but long and sometimes very rough. Probably it is the toughest travel problem for radio relay maintenance. On a trip there last year, some men were driving the Sno-cat over 20 feet of snow in front of a ski lodge when a woman called, "Would you please move that thing? It's sitting on top of my convertible." She had parked her car there before the snow fell, and by this time it was covered by several feet of snow. (The car was eventually dug out and was none the worse for its cold storage.) An aerial tramway over the last 1400 feet provides winter access to the Mt. Rose station.

Experience has shown that it is possible to be caught in a snowstorm after reaching some stations and an immediate return to the maintenance center rendered out of the question. So, some of the comforts of home are provided in a number of the most inaccessible relay stations to make possible a stay of three or four days. In one station, located on a mountain top, there is an electric stove, a deep freeze, a bathroom, and plenty of magazines.

Interestingly, the Mt. Diablo radio relay station—the first auxiliary station south of San Francisco on the San Francisco-Los Angeles route—is in the Mt. Diablo State Park, and was designed to fit in with its rustic surroundings. The view out of the window affords a glorious picture of the California scene.

The Expanding Outlook

Our first attempt at maintaining microwave apparatus was early in 1947 on the then experimental New York-Boston radio relay route. Here we were taught some basic principles. As our experience with radio relay lengthens, and new circuit designs and newly designed tubes are introduced, we become acquainted with

Up hill in a "sno-shu." Getting off an unmarked road and onto a drift with a treacherous "overhang," like those shown behind the vehicle, is a winter hazard their behavior and the precise methods required to keep the network operating effectively.

As each new leg and routing has been established on the expanding Bell System radio relay network, maintenance problems and methods are reviewed on the basis of this increasing experience, and plans are made for handling the still larger network of the future.

Whether the Bell System radio relay equipment is on a mountain top, in the hot southland, or half way up a steel tower—a "cabin in the sky"—on the Midwest plains, the maintenance forces are geared to do their jobs quickly and precisely. Not all such work is done in picturesque spots, for more often than not the stations are ordinary places where there is just a room full of radio equipment at the end of a dusty road. Yet here, as in the most exciting location, a well-planned maintenance job keeps the service going strong.

No group has been more unwisely and unfairly treated than the service industries. Yet the railroads, the power and light, the gas industries, and those furnishing communications employ millions of workers, dependent for livelihood on the success of these industries, which are vital to all other industry and to the general consuming public.

The way the government has been regulating these service industries reminds me of a gentleman who owned a farm up in my part of the country some years ago.

He had a manager who ran the farm and gave him regular reports on the operation. Now this owner figured that the way to make money on a milk farm was to watch expenses like a hawk. This he did, and complained regularly about expenses and particularly about the feed bill, the largest single item.

He finally learned—the hard way—that you don't make milk by stinting on the feed, and the same is true in regulation. If we want service from a service industry, a full diet—in terms of income—is clearly to be desired. And the people, if they understand, would want it this way. They don't go around with the balance sheet of the motor companies, the electric companies, the chain stores, etc., so as to be sure to buy the products of the companies that make the least money.

Nor do you, when motoring through the country, stop at the most run-down-looking roadside stand on the assumption that the worst looking farm sells the best produce at the lowest price. That philosophy is about on a par with the manufacturer who refuses to buy better machinery in order to reduce costs, but figures he can do it by cutting wages and lengthening hours.

Both are running against the well-established tide of American progress.

In regulating utilities and in managing other things, it is cheaper for the public in the long run to have those that serve it well-fed and strong, rather than half-starved and weak. There are ways of getting good service out of the strong. No one can get it out of the weak.

—From an address by Sinclair Weeks, Secretary of Commerce, before American Iron & Steel Institute on May 28, 1953

The Methods of Employee Protection Adopted by the Bell System Companies in 1913 Have Demonstrated Their Worth To Workers, Company, and the Public Service

Benefits and Pensions Have Proved Value for 40 Years

I. An Effective Adjunct to An Essential Public Service

Eugene J. McNeely

IT WAS 40 years ago last January 1 that the Associated Companies of the Bell System put into effect arrangements to furnish their employees certain benefits at times of illness, accident, and death, and to provide pensions for those meeting the eligibility requirements.

This was a broad and far-reaching undertaking. The men who had been given the responsibility of investigating and preparing for it realized, moreover, that they were providing plans for a complex business which was engaged in rendering an essential service to the public. The telephone business must, by its very nature, be a continuing enterprise, and its successful operation calls for a fine organization with sustained vitality.

In order to promote such an organization, these men recognized, it was advisable to make reasonable provision for those hazards of life which may interrupt earning capacity and place unexpected and sometimes heavy financial burdens upon individual employees.

They also felt it advisable to assist in solving the problem of aging personnel through an appropriate retirement plan. This, they believed, would eliminate the expense of superannuated employees, guard against deterioration of the service, and promote the vitality of the organizations.

The farsighted vision which was woven into the Bell System companies' Plans is apparent when one considers that these steps were taken many years before such practices became general and, of course, long before the recent trends in social security now provided through legislation.

The principles involved here are especially pertinent to the telephone service, which includes a large human element. To obtain satisfactory results from such organizations, it is important that employees know their jobs and also that their morale be high. These conditions lead to efficiency and good service. The Plans have aided materially in attaining this end by providing a sense of security on the part of the employees to offset to a reasonable extent the uncertainty and fear regarding financial need which are ordinarily associated with physical impairment, old age, and death.

The results obtained from having had these Plans in effect over a period of forty years clearly demonstrate their value to the employees and to the companies.

II. The Protection of Employees Against Certain Hazards

Charles J. Schaefer, Jr.

THE BENEFIT AND PENSION PLANS adopted by the Bell System Companies in 1913 were among the finest as well as among the earliest in industry. Today, 40 years later, they are still among the leaders.

When all the features of the sickness disability benefits, the accident disability benefits, the death benefits, the disability pensions, and the service pensions are taken into consideration, they add up to Plans which rank among the best.*

A few figures will reveal some significant facts. So let's take a look at the matter of growth in numbers. In

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* This general discussion cannot be complete nor definitive. A comprehensive and exact statement of the terms and provisions of the Plans is given in the pamphlet "Plan for Employees' Pensions, Disability Benefits and Death Benefits," as published by each of the Bell System companies.

1913 there were about 177,000 employees in the Bell System companies. In 1952 there were about 692,500 employees, an increase of 515,500 or almost 300 per cent, in these companies. At the end of 1913 there were about 120 pensioners, while at the end of 1952 there were about 34,000 service and disability pensioners. To set up and maintain pension plans to meet such a rapid increase in the forces introduced many problems.

Some idea of the cost of operating the Plans is obtained by a comparison between the first year's cost (1913) and the cost for the year ending December 31, 1952. During the first year, the Bell System companies, including the Western Electric Company, paid out $1,153,128 for all the purposes covered by the Plans. In the year 1952, the amount was $213,825,349. This latter sum is made up of the following items:

Sickness disability benefits	$ 32,856,327
Accident disability benefits	1,915,884
Death benefits	6,905,397
Disability pensions	3,001,809
Payments to Pension Trust Funds	169,145,932
Total	$213,825,349

In addition to the above, the Companies paid out during 1952 $28,646,173 from operating expenses for the first seven days' sickness absences † and other miscellaneous items; and $33,533,186 in Social Security old-age insurance benefit taxes. This makes a grand total of $276,004,708.

Before 1913

The Bell System Companies' benefit and pension plans went into effect on January 1, 1913; but they did not spring into existence over night. A great deal of research, of planning, of plain hard work preceded their adoption.

At the time when the plans became effective there were, in addition to certain governmental plans, some pension plans in older industries—more particularly the railroads. But by and large, these covered only a small portion of the employees in industry. For others, any forms of protection, if provided at all, were entirely discretionary, and there was little assurance of security or uniformity of

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† Any payments for illnesses of less than eight days are not charged to the Benefit Plan accounts.

treatment. With increasing industrial expansion, however, the need for such protective measures for employees was becoming more fully recognized.

Before 1913, a number of the Bell System companies had informal practices which provided financial assistance in connection with disability and death and which assisted in varying degree those long-service employees who, because of age or other infirmities, were unable to continue on active duty. In other instances, some protection was provided by mutual-benefit associations or through similar employee activities—with or without company participation. A few of the older companies had somewhat uniform practices in effect which made some provision for retirement, and one company had adopted a formal retirement plan as early as 1906.

The Plans adopted in 1913 by the Bell System companies provided uniformly substantial benefit and pension protection; and, through interchange agreements, they enabled employees to move from one company to another in the System and continue to enjoy the advantages of the Plans. This was and has continued to be distinctly advantageous to both the employees and the companies.

In the past 40 years, the Bell System Benefit and Pension Plans have been amended on a number of occasions to meet changing conditions, and these amendments have meant a broadening of the provisions of the Plans, to the advantage of employees.

The effect of the Benefit and Pension Plans upon employees is to cushion the blows of illness, accident, old age, disability, and death. Their economic and administrative justification lies, however, in their ability to maintain, within an essential public service, organizations of sustained spirit and vitality. Contributing substantially to these attributes are the features of the Plans which provide an orderly program of retirement for older employees. Since the inception of the Plans, 49,425 employees have been retired on pensions.

The principles underlying the Plans are that they be designed to meet effectively, for the future as well as the present, the needs of the business; that they be financially secure; and that they balance fairly the particular interests of telephone workers, telephone users, and telephone share owners. The interests of these three groups are interdependent.

The benefit and pension provisions of each of the companies' Plans are important in achieving these purposes.

The sickness, accident, and death benefits—which, like pensions, are provided at company expense—bear a fairly constant relationship to wage and salary payments, and so they are paid out of current expenses as required.

The Pension Plans of the Bell System Companies

THESE PLANS are generally accepted by pension authorities who are familiar with their provisions as exceptionally good and, indeed, outstanding industrial plans. They are financially sound, and their eligibility provisions treat all employees alike on the basis of their wages or salaries and the length of their service in Bell System companies. They are "trusteed" Plans, for which funds are provided on a sound actuarial basis so that pensions will be available for employees when they retire.

It is essential to the best interests of every employee that the terms and conditions of the Plans be maintained in accordance with sound pension practices. A pension plan is not something which can be changed from year to year; pension planning is by its very nature a long-term proposition, and must be so recognized if it is to be more than a temporary gesture.

Pension plans cost a lot of money. In order to provide essential security for the future, there must be reasonable assurance of meeting the bills in the years ahead—in good years and bad years. Without such security, pension plans are unreliable promises.

Good pension plans must be thoughtfully conceived, carefully designed, fairly administered, and soundly financed for the long pull.

Special Features of the Plans

IN THIS COUNTRY TODAY about 15,000 pension plans of various types are in effect. They are too numerous and varied to permit comparison here, but some of the features which distinguish the pension plans of the Bell System companies from others may be pointed out.

These Plans of the Bell System companies are non-contributory, and their payments are provided without any direct or indirect cost to employees. So, in making comparisons with plans to which employees contribute, it must be kept in mind that a part of the pension under such plans is purchased by the employees' own contributions. The pensions compare most favorably with the part provided solely at company expense in these other plans.

Another point to take into account is that while every Bell employee begins, on the day he or she enters the business, to acquire credited service for eligibility to the Pension Plans, many other plans limit employee participation in terms of age, of earnings, of length of service, or in other ways.

A number of plans require, for instance, that employees be 25, 30 or even 40 years old before they can receive pension credits or participate in the pension plans. The most common age requirement is 30 years, and if this were used in computing Bell System pensions, it would reduce most of them by very substantial amounts.

Another requirement of some pension plans is a certain period of service—usually from one to five years—before an employee may participate in the pension plan. This practice, too, if applied to Bell System pensions, would reduce them substantially. If, for example, five years of service were required before an employee began to receive pension credits, the amount of the service pension would be reduced, on the average, by about 15 per cent.

Another common practice in pension plans is to "discount" pensions granted ahead of the normal retirement age. In these plans, the normal retirement age is usually 65, and the pension as computed by the regular formula is discounted for each year of retirement before 65. On the average, Bell System men retire at age 63 years and women at 58. If the discount feature common to most plans were applied to our pensions, men's pensions in the average case would be reduced by about 15 per cent and women's pensions by almost 40 per cent.

Some pension plans compute pensions differently for employees in different wage or salary groups. In the Bell System, all pensions above the minimum are figured on exactly the same basis for everybody.

The Pension Plans and Social Security

Although it is customary in the great majority of industrial plans to make adjustments in pensions, directly or indirectly, because of Social Security benefits, this common practice has been the subject of considerable misunderstanding. It may be useful, therefore, to review briefly the underlying principles regarding the practice as it applies to the Bell System companies' Plans.

Looking ahead 40 years ago, the men who worked out the various conditions of the Plans could see even then the future possibility of laws requiring all industries to pay for pensions to their retired employees. But since those men were then establishing a pension system paid for wholly by the companies that was fair and liberal, they included the proviso that any pension set up the government should become part of the retirement income the companies provide for their employees.

In other words, the pension plans have included for 40 years the sensible provision that the companies shan't be put to the expense of duplicating their benefit or pension payments.

More than 20 years went by before that particular proviso had much application—other than avoiding the duplication of accident disability benefits provided by the plans and workman's compensation payments required by law. Then, in 1935, Social Security became law. The law requires that Bell System companies, along with all others, make payments into a national pool or fund from which benefits will be paid, under certain conditions, to qualified persons at age 65.

So there were the Bell System companies, paying into two pension funds: their own long-established funds, and the government's new fund. That was the situation which had been anticipated.

There is one aspect of it which had not been foreseen, however. This is that by law both company and employee pay—and pay equal amounts—into the Social Security fund.

So, instead of considering *all* of the amount of the Social Security pension in the retirement income the company provides for its employees at age 65, the company includes only half of it. This is because the company and the employee pay equally into the Social Security pool, and it seems fairer to count only the half of the Social Security pension which the company paid for in figuring the total retirement income which the company provides for its employees when they reach 65.

Social Security payments do not begin until age 65. So a company employee who retires before that receives his or her pension from only one source: the company's pension trust fund. Beginning at 65, the employee receives his or her pension from two sources: Pension Plan trust fund of the company, and Social Security fund; and the total then equals the full amount of the retirement income provided at company expense *plus* the half of the Social Security pension resulting from employees' tax contributions to the government through payroll deductions.

Social Security old-age benefits represent a form of group insurance, as contrasted with benefits provided on the basis of individual contributions. As is true of any insurance system, the Social Security Act gives the assurance of protection to all who become eligible for payments, at the general expense of all who contribute in the form of taxes to the fund from which the payments are made. For this reason, the total amount of Social Security benefits which any individual may receive cannot be related to the total of the taxes which have been contributed either by him or by his company in his behalf.

As under all insurance systems, some people stand to get more than others; some will receive more and others less than the total amount of

taxes which they and their employers have contributed. This "averaging" is the fundamental principle on which all forms of insurance are based. Just as it is inconsistent with the basic theory of the Social Security Act to relate the Social Security benefits received by an employee to the taxes he has paid, it is also inconsistent to relate the adjustment of his company pension to the taxes paid by the company in his individual case.

So long as industries are expected to provide one-half the funds from which Social Security benefits are paid, it follows that they must, over the long pull, coördinate the pensions provided under their private plans with Social Security payments. Money paid to the Government by the Bell companies to provide pensions for the employees who work for them must be considered along with money paid out to meet the expenses of their private pension plans. Both of these items represent real costs to the companies; in the long run their Pension Plans, to avoid duplication of pensions at company expense and to be of a sound and continuing character, must give full weight to the fact that half the Social Security payments are financed by the companies. The Plans are similar in that respect to most other industrial pension plans.

Security of the Pension Plans of the Bell System Companies

Too much emphasis cannot be placed on the prime essential of any really good pension plan: *security*.

Unless there is security, employees have no assurance of receiving the pensions to which they have become eligible upon retirement. When insecure pension plans fail, they work grave hardships on employees at a time when their earning powers have decreased or ceased entirely and when they will probably have little chance to get going again to provide for their later years. This has been the unfortunate experience in a number of other pension plans over the years, especially during depression periods.

The Plans are outstanding in respect to their security. The pension funds trusteed under the terms of the Plans must be used *solely and entirely* for service pension purposes. Amounts accrued on an actuarial basis are paid into the funds currently, to provide for payment in full of the pensions as they become due and for the continuation of such payments during the remaining lifetime of the retired employee. The amounts thus provided over the years are sufficient to meet, by a substantial margin, all matured pension liability: i.e., the amount required to pay in full the pensions of those already retired and those entitled to retire at their own request. The balance in the funds, with current accruals and interest earnings, will provide for future pensions as employees become eligible to them.

WITH such essential security, with due recognition of important pension principles, and with the application of good judgment, the Benefit and Pension Plans of the Bell System companies will continue in the years ahead to fulfill their important functions, to the mutual advantage of employees, share owners, and the public.

Prolonged Disruption of a City's Electric Power Plant Put Telephone People, Equipment, and Emergency Plans To a Severe Test

"The Service in Toledo Did Not Break Down"

John H. Page

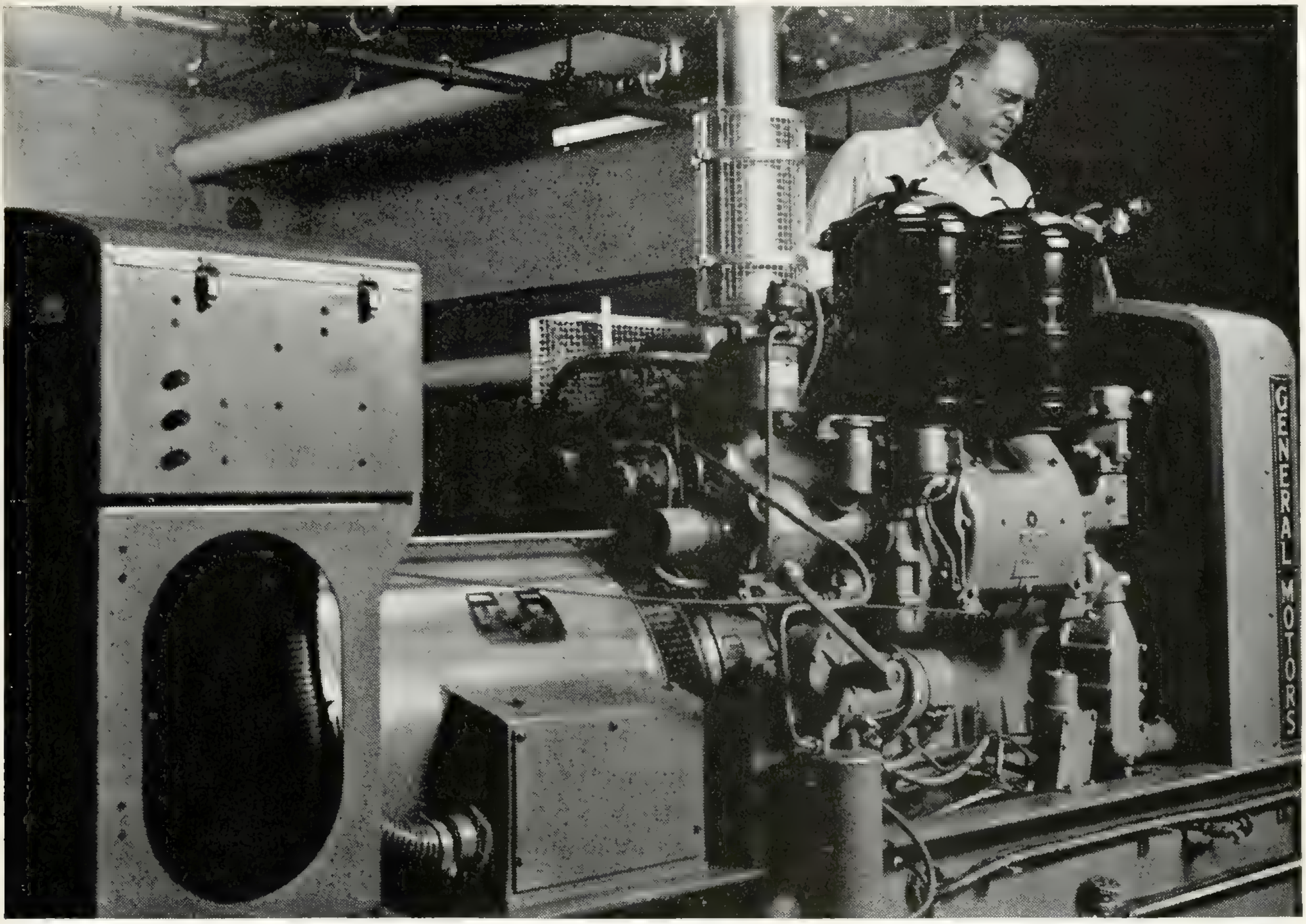
That telephone service in Toledo did not fail is not surprising: it is failure which would have been surprising. For throughout the Bell System, plans have been made and equipment has been installed to safeguard the pathways of communication against hazards far greater than those encountered in the Ohio city last April. The incident is recounted here, therefore, simply as indicative in some measure of the readiness of the System—its people and its plant—to meet and handle whatever kind of emergency, from whatever source and wherever encountered, these troublous times might bring. EDITOR

RESIDENTS of Toledo, Ohio, woke up to quite a shock on last April 6th.

In the first place, some of them were a little chilly, for their electric blankets had gone off at 6:05 a.m. Then electric razors wouldn't work, toasters wouldn't work, electric stoves wouldn't work, the lights in the closets wouldn't work—but this was minor. After all, the electricity had failed before for short periods, so the man of the house dug out his safety razor and resigned himself to an old-fashioned shave. Then he turned on the water tap—and no water flowed. "This *is* unusual," he thought. "I'll try the radio to see what's happened"—and it didn't work.

"How about the telephone?" He tried it—it *did* work. In fact, it worked overtime. It handled nearly three times as many calls in Toledo on April 6 as on a normal day.

Of course, for the telephone to work during a minor power failure is hardly news, but the April 6 power failure in Toledo was unusual. It



A modern generating unit, with completely self-contained cooling system. It is capable of supplying all power requirements of a central office, including normal lighting—and did so at the Walbridge office during the Toledo power failure

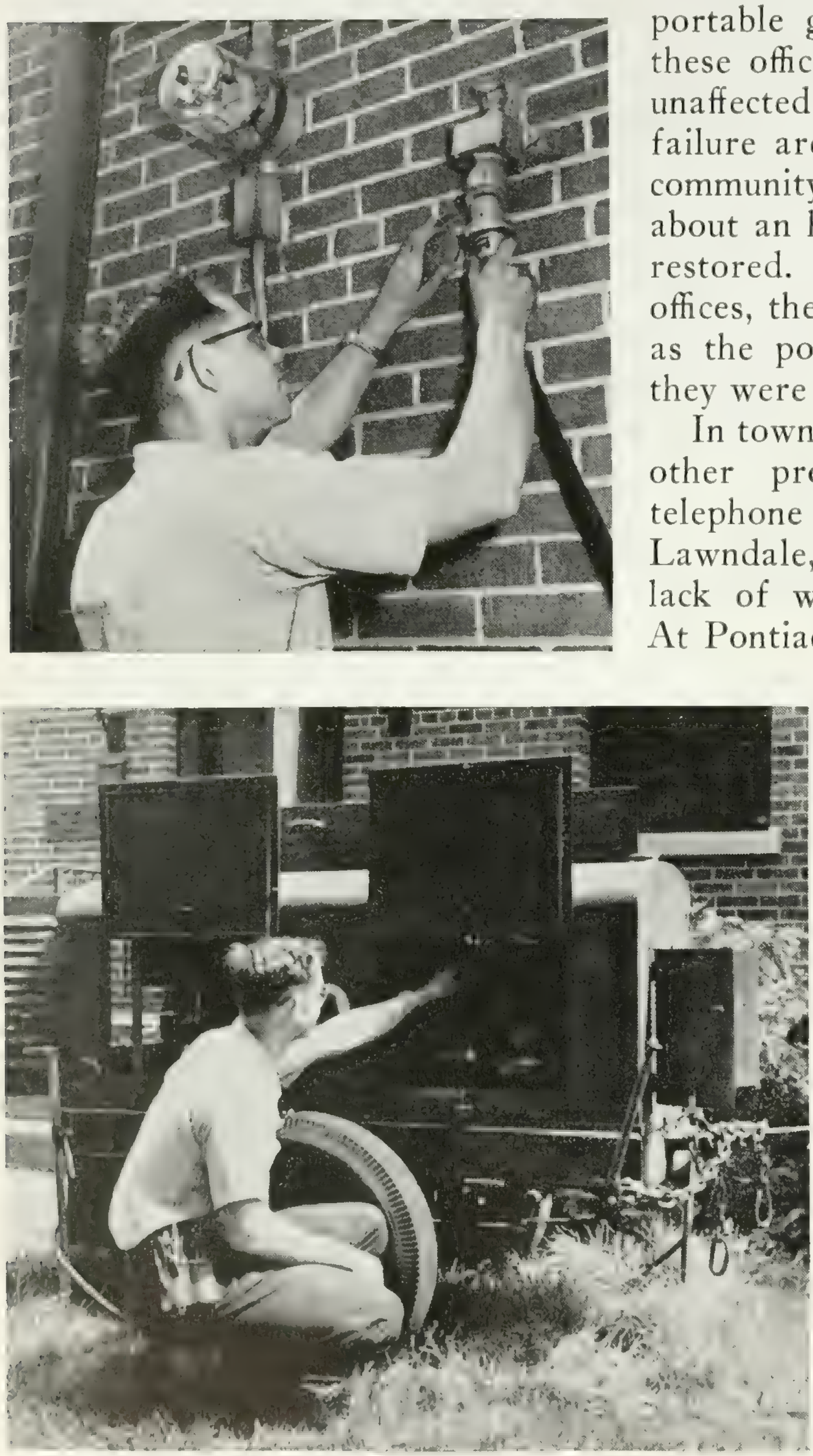
was complete and prolonged. All parts of greater Toledo were without electric light and power for nearly two hours, and it was nearly five hours before electricity once more surged through all the power lines. This meant hospitals, fire departments, business buildings, factories, radio stations, homes—all segments of the community—were at a standstill. Moreover, since the pressure for Toledo's water system is provided by electricity, it too came to a dead stop.

While this Toledo "disaster" was not in any way comparable to a major catastrophe, or what would occur in the case of a bombing attack, it did provide an opportunity to see how telephone procedures, equipment, and personnel functioned in an actual case. As one plant man put it, "We learned more in those five hours than we ever did in our many 'paper' disasters."

Emergency Equipment on Hand

GREATER TOLEDO is served by step-by-step dial equipment in six main central offices and four community dial offices. Here is a quick look at how each of these operating units worked without the electricity normally supplied by the Toledo Edison Company.

At 6:05, when the power failed, all battery charging equipment stopped. Telephone service did not. Batteries took over the job of supplying needed power. In the six city central offices, auxiliary gasoline or diesel engines driving generators were soon started, to keep a steady surge of electricity flowing into the batteries.



A typical gasoline-driven portable generating unit outside the Perrysburg community dial office. The upper picture shows how its conductors are plugged into the terminal outside the building

In the four community dial offices, there are no auxiliary engines for running generators. Ordinarily, the batteries will carry these offices for a good many hours, but central-office foreman Walter Hettle was taking no chances and, within an hour, had portable generators beside three of these offices. The fourth office was unaffected, being outside the power failure area. The generator at one community dial office was used for about an hour before the power was restored. At the other two C.D.O. offices, the generators were not used, as the power came back on before they were needed.

In town, in the main central offices, other problems were confronting telephone people. At the Pontiac, Lawndale, and Jordan exchanges, the lack of water was causing trouble. At Pontiac and Jordan, this problem quickly solved itself when the water pressure was restored about 7 o'clock. At Lawndale, however, central-office foreman Frank Randall found this didn't solve his problem. When the water came back, he again started up his auxiliary generator; but the sump pumps, for removing the cooling water from the basement, were dependent on commercial power, and didn't work. But Frank Randall was equal to the occasion: he called on the Construction Department to bring over an auxiliary pumping unit to empty the basement of the cooling water. And, just as double protection, he procured a portable generator, which he kept standing by.

What must have made Frank Randall's job the more frustrating was that sitting in the basement, all ready to go except for the wiring of the control panel, was a new diesel generator with a self-contained cooling system. Similar auxiliary generators with their own cooling systems had already been ordered for the other offices, even before this emergency emphasized the need for such equipment. Had the water failure persisted, still other—if more complex—methods were available to get the generators going in time.

> *Much work and planning has been undertaken to make the telephone system capable of withstanding unusual conditions. It is not the purpose of this article to evaluate the strength or weakness of our disaster planning and procedures; but, in gathering the material for this story, one cannot help but be impressed by the effectiveness of what has been done for just such an occasion. Likewise, one cannot help but be impressed by the performance of telephone people during this power failure.*

The Message Went Through

IN THE MAIN BUILDING, where the Main–Adams central office is located, and at the Walbridge central office, things were running more smoothly. At both of these locations, diesel generators with self-contained cooling systems were steadily pushing the needed electricity into the telephone system. In fact, in the Main building, all lights were working and one elevator was delivering passengers in normal fashion.

Some of these passengers were extra operators for the D.S.A. switchboard, for this board was very busy. Chief Operator June Mangold was home in bed at 6:05 when the night chief operator called her. By 6:30 she was in the office. She held night operators over, and quickly filled all her positions by calling in extra operators and borrowing girls from the toll office.

Apparently a great many people rely on electric clocks to govern their day-to-day operations, for the TIME OF DAY service was extremely busy. So was the Toledo Edison number—with nearly every Toledoan trying to get his personal complaint to the beleaguered utility. Many of these calls ended up at the D.S.A. board, and here the operators did yeoman service explaining the power failure and re-orienting many a time-conscious American. Some probably missed their regular bus despite the girls' help—but this wasn't a normal day in Toledo.

Of course many a call was made next door, to families, and to friends, to see how they had cooked breakfast or heated the baby's bottle, but emergency calls also helped build up the load far beyond normal. Interestingly, some of the emergency calls were made by the Toledo Edison Company in procuring reserve power from the Midwest power pool.

They knew what to do and how to do it, and knew they had the authority to do it: *Central Office Foremen Frank Randall, Otho Banning, and Edward Lasko*

Actually, the power failure was the result of trouble in a circuit breaker at Toledo Edison's main generating plant. This caused a 69,000-volt arc to flash into the bus structure, through which all electricity is distributed to the various power lines. It was because this key distribution point suffered damage that Toledo Edison took longer than usual to switch in reserve power from other sources in the Midwest area.

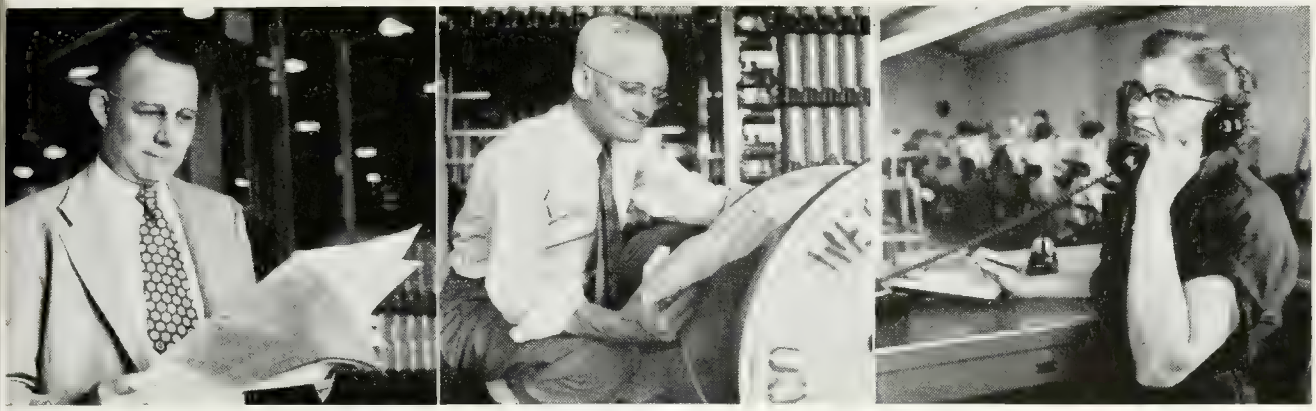
The Plans Are Made

To many customers, one of the qualities that makes a telephone invaluable is its reliability. To the customer, this means constant convenience and, in times of emergency, protection for his home and family. The Bell System has always recognized the importance of providing reliable service. The concept of preventive maintenance, high standards of equipment, and many practices and policies are a direct effort toward this. Today, the importance of reliable service has even greater significance because of the possibility of hostile attack and the resultant importance of dependable communications.

In Toledo, emergency procedures had been worked out during regular monthly meetings of the Disaster Committee. Auxiliary generating units existed in all main exchanges, and nine portable generators of various capacities were on hand in dispersed locations. All units were tested and run weekly, and people were trained in their use. These and many other actions made our plant capable of continuing to give service during the power failure.

But, when all is said and done, these preparations alone would not have kept the service functioning. People were needed to direct and use this equipment.

In the Toledo case, five central office foremen and a chief operator, representing 192 years of telephone knowledge and experience, were the key people. They knew what to do, they knew how to do it, and knew they had the authority to do it. True, hours and hours of laborious planning and effort to provide them with needed equipment stood behind



These six supervisory people have a total telephone experience of 192 years: Central Office Foremen Walter Hettle and Charles Ragen and Chief Operator June Mangold

them, but in the emergency they acted—they used the equipment on hand to see to it that the telephone *did* work. Their experience and capacities, like their colleagues' all over the Bell System, are an unvaluable asset available in any emergency.

As one plant man put it, "Everything didn't work perfectly, we hadn't foreseen all the situations, but it certainly shows we are on the right track; and, what is important, the service in Toledo did not break down."

The Spice of Life

(From the London *Times*)

The telephone directory is generally considered to be a pretty unexciting publication. It is true that its growing bulk reminds the possessor of a telephone of the startling fact that he can be rung up by more than five and a half million other subscribers in this country alone. Yet, on the whole, the neatly printed columns, the serried ranks of Browns and Smiths contain little to fire the imagination.

The classified directory is another matter. At first sight this appears to be a mere rearrangement of the same names under convenient headings, a splitting up of the Browns and Smiths according to their occupation as solicitors or ladies' hairdressers, building contractors or doctors.

The telephone subscriber in the London area who idly turns the pages of this formidable volume finds, all the same, quite a few surprises. There are, for example, the farmers—820 of them—to show that within its wider confines the capital is not all rooftops. . . .

Makers of air-tight chests and bowling greens, of crimped paper cups and collapsible gates, of bandsaws and bung tins are listed for him in the book. Telephone cleansers and tripe dressers, turtle merchants and caviare importers await his order.

To arouse his curiosity there are manufacturers of kieselguhr and Tripoli powder, cullet merchants and pirn makers. If these do not satisfy his wants there are stabilizing food agents, glass benders, oily water separators, and a solitary flong merchant.

"When a man is tired of London," remarked Samuel Johnson, "he is tired of life; for there is in London all that life can afford." The aphorism seems to be as true today as ever it was.

Three Decades of Organized Campus Recruiting of Qualified Seniors Supplements Leadership Potentialities of Able Men And Women Already in the Organization

Bell System Employment for College Graduates

Donald S. Bridgman

THE BELL SYSTEM'S 1953 college recruiting efforts are now about over. Recent graduates of two or three hundred American colleges and universities have elected to join one or another of the System's score of organizations. By now they either are getting used to their new jobs in the telephone business or are about to report for their first assignments.

Graduation put an end to active recruiting efforts for 1953, it is true—but not to the recruiting program. That is a continuing activity, which has been going on for many years. As long ago as the beginning of the present century, individual executives of some Bell System companies had been going to certain colleges in an effort to interest able seniors—mostly engineering students—in entering their companies after graduation. By the onset of World War I, this activity had expanded into some organized interviewing on college campuses by a few System companies.

With the expansion of the telephone business in the 'twenties, there was an increased need for college graduates, and most of the System companies began to visit college campuses regularly in search of first-rate men—still largely graduates in engineering and physical science. In 1922 a coördinated plan for college recruiting in the Bell System was established. This plan, which has been developed and improved over three decades, is in effect today.

Purpose of the Program

THE BELL SYSTEM'S college employment program exists for the purpose of securing from the country's colleges and universities the services of young men and women who can provide specialized knowledge and skills and, in addition, a leadership potential to supplement that of outstanding employees who are coming up through the ranks.

Part of the Murray Hill, N. J., installation of the Bell Telephone Laboratories

The program is a natural outgrowth of the increasing number of young people who take advantage of the many opportunities in this country to obtain college educations. In 1900, only one young person in 60 graduated from college; today about one in eight does so.* For men, the present ratio would be about one in seven; * for women, one in eleven, since men receive more than sixty per cent of today's bachelor's degrees.

No longer do the colleges attract only those students who come from well-to-do families, as was largely the case fifty years ago. Regardless of their parents' circumstances, many young people of ability and determination now find reasonable ways to secure college training, and enter their life work only after completing it.

The native ability of most graduates, moreover, has been further developed by intellectual discipline and contact with many different fields of learning through their college years. Knowledge and skill in some of these fields, such as engineering and physical science, economics and other social science, and accounting, statistics and other aspects of business administration have become increasingly important for business organizations and are acquired through extensive college training. Here again, there has been a great change since early in the century, when nearly half of all college graduates were preparing for the professions of law, medicine, dentistry, and the ministry. Today only seven or eight per cent are doing so, and the majority look forward to business careers.

Both such developments in college education and the increased complexity of business led the Bell System companies, as well as many other organizations, to seek college graduates for technical and other phases of their work and to provide a reasonable proportion of their future leadership.

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* Ratios do not include veterans whose graduations have been delayed.

Limited Numbers to Be Employed

In determining the number of college graduates to be employed over a period of years, the Bell System companies are governed by three principal criteria:

(1) How many graduates will be needed to fill positions requiring technical or other specialized college training?

(2) How many with such training or more general college training will be needed to fill future management positions without blocking opportunities for the advancement of equally able non-college employees in the ranks of the business?

(3) How many graduates can progress in the business in line with the investment of time and money in their education, their reasonable expectations, and their opportunities in other fields?

The Bell System companies also recognize fully that they have in their ranks large numbers of able employees without college training or, in some cases, uncompleted college training, who are highly qualified candidates for supervisory, staff, and executive positions. The appeal of telephone work generally and the careful selection of all System employees make it inevitable that among the men and women in these companies there will be many who have the outstanding character, personal qualities, and intellectual ability which, added to the knowledge gained from experience, result in fine leadership potentiality. Management gladly accepts its responsibility to develop fully and advance such employees.

Certain characteristics of this business, however, make it particularly important that the Bell System obtain a substantial number of the country's new graduates of outstanding ability and finest training. These include the System's constant search for improvements and economies in its services, the complexity and highly technical character of telephone equipment, the need to exercise good judgment in making large expenditures, and the variety of its operations.

Fortunately, the telephone business offers an unequalled opportunity to those graduates who demonstrate outstanding ability and future potentialities to utilize their special training and to fulfill their purpose in securing it. Such an opportunity grows out of the interesting and varied work to be done, the rapid growth of the business and the chance for advancement that accompanies such growth, and the satisfaction that comes from participation in an essential, forward-looking service industry.

Thirty Years of Activity

What have been the effects of this program over the past thirty years on the balance today of college graduates and other employees in the supervisory, staff, and technical positions of the System Companies? As might be anticipated, the proportion of graduates in such positions is highest in Bell Telephone Laboratories, where thorough training in engineering or physical science, either in college or by intensive self-study, generally is indispensable. Of the Laboratories' technical and other staff positions, five-sixths are filled by college graduates, of whom almost one-third have masters' or doctors' degrees. About one-eighth of these graduates, recognizing the importance of technical training for the Laboratories' work, have obtained their degrees through evening courses.

In the Operating Telephone Companies, college graduates fill approximately half of all positions at and above the district level or its equivalent. Naturally, this ratio varies between companies and, within the companies, between departments. It tends to be highest in the Engineering Departments because of their special technical requirements and lowest in the Plant Departments, with their large reservoirs of able non-college men.

In the Western Electric Company, the situation is similar, with about half of the positions at the level of assistant superintendent or above filled by college graduates.

For individual promotion, of course, the selection is based on established merit of the candidates, regardless of educational background except as requirements of the position make them important.

Organization of Recruiting Work

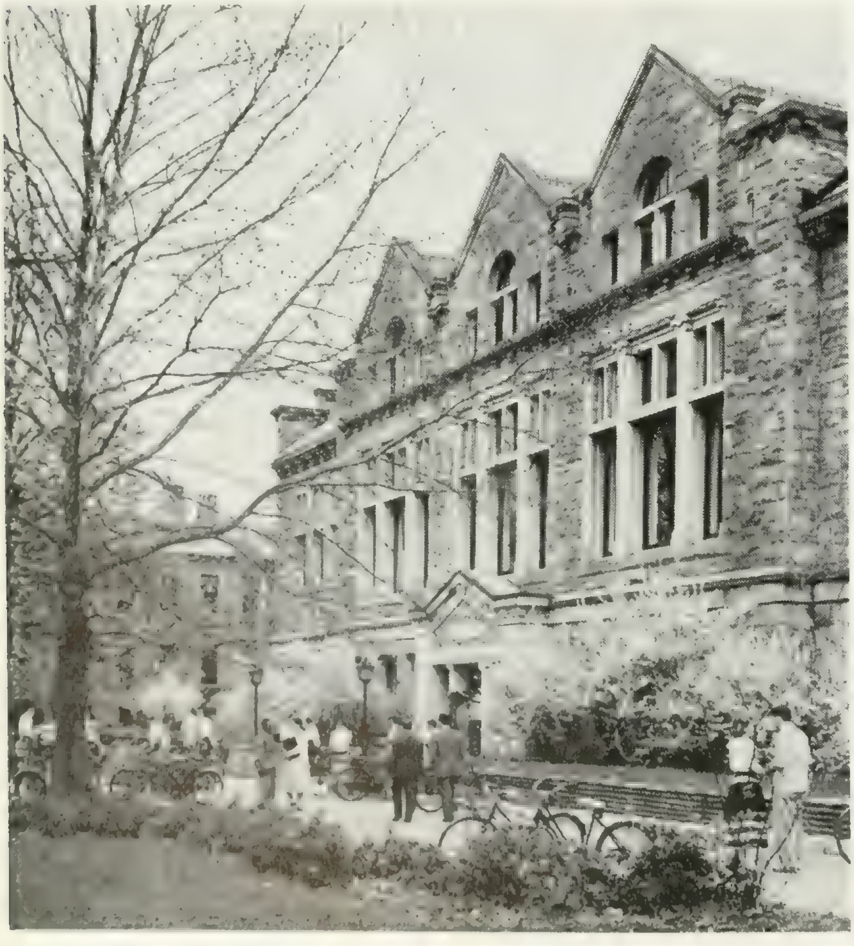
As the importance of college graduates to the business increased with their rising numbers, organized efforts have developed to secure those graduates best fitted for the System's work, and for some years college recruiting has been on a systematic basis. Today, under this plan, each Operating Telephone Company is primarily responsible for maintaining relations with the institutions in its territory and for making arrangements for visits of representatives of any Companies interested, to interview candidates for employment. At each institution from which more than one System unit wishes to secure men, these representatives visit the campus as a team, and each candidate is enabled

Massachusetts Institute of Technology, one of the many engineering schools whence recent graduates enter the Bell System to interview the representative of any Company in the work of which he has a special interest. At the larger technical institutions, such a team is generally made up of representatives of the Associated Company in that territory, the Western Electric Company, Bell Telephone Laboratories, frequently of the Long Lines, and in recent years the Sandia Corporation—which is operated under contract with the Atomic Energy Commission by the Western Electric Company.

Students who are interested in Companies which are not represented on the campus, particularly Associated Companies at a distance, are interviewed and their records are referred to those companies for consideration. Through these arrangements, the whole range of System opportunities in all parts of the country, including operation, manufacturing, and development and research, can be presented to students of varying interests, and those who appear to be well fitted for Bell System work may receive offers of employment, or assistance in arranging subsequent interviews, with the System company for which they have the greatest interest and aptitude.

This type of recruiting activity on college campuses has become more and more essential because of similar efforts carried on by an increasing number of other businesses. As a result, a high proportion of the outstanding men in each senior class are likely to have accepted employment some time before graduation. Recruiting activity on the college campuses, however, in addition to providing direct access to outstanding men there, tends to stimulate interest in the Bell System's work on the part of other students who may delay selection of their first job or who may find it necessary to change employment some time after graduation. For this and other reasons, a substantial number of well-qualified college graduates are employed as the result of direct application at Bell System offices.

Since the start of the Korean war, the large



Oberlin College, one of the smaller Arts institutions contributing their share of graduates to Bell System enrollment requirements of the Western Electric Company and Bell Telephone Laboratories in connection with their contributions to the defense effort, in addition to their work for the Bell System, have substantially increased the needs of those companies for engineering graduates. Similar needs have developed in outside industries and, as a result, the demand for new graduates in engineering in recent years has been greater than the number of men receiving degrees.

Bell System buildings—such as this of the Ohio Bell Telephone Company in Dayton—are architecturally appropriate to their surroundings, and in their substantial character and careful planning reflect the stability of the business and its regard for customers and employees

The Bell System and the Colleges

The success of the Bell System's college employment program will depend in the long run upon cordial and mutually constructive relations with the colleges and universities and their faculty members. Since the establishment of coördinated college recruiting, early in the 1920's, a number of activities have been undertaken to promote such a relationship.

In order to assist the larger engineering schools in their teaching of problems most usually encountered in communications, a substantial amount of communications laboratory equipment has been made available to a number of such schools. During the 1920's, the Bell System companies held three conferences with faculty members in the fields of electrical engineering, mechanical engineering, and business administration and economics, to acquaint them with problems encountered in the telephone business, and the types of opportunities it offered to their graduates.

During more recent years, one Bell System company has held similar conferences with college faculty representatives, primarily to give them a better understanding of the telephone business; and other Companies are planning similar conferences. Such meetings improve college relations in general, and strengthen the opinion that the Bell System is a good place to work.

University of Michigan is one of the large state universities whose recent graduates find employment in the telephone business

Statistical studies of the relationship between certain factors in the college record and later progress in the System companies were undertaken more than 25 years ago, and the results of the first study of scholarship for this purpose were published by Mr. Gifford in 1928. This study brought out that, in general, the probability of above-average progress in the System's work was definitely greater for the type of men who had stood high in their college classes than it was for those whose records had been average or below. As the result of additional studies, a similar but somewhat less significant relationship was found between extracurricular achievement in college and progress in the System. More limited studies of this same kind have been conducted from time to time in the intervening years and in general have confirmed the results first obtained. Similar analyses are being continued. The general conclusion to be drawn from this work is that although for large groups of graduates better than average achievement in college is likely to be followed by similar progress in business, there are many individual exceptions. Certainly, there is no single objective factor, such as college scholarship, or any combination of similar factors, which will predict success in the Bell System's work with any degree of accuracy. Sound judgment, based on experience and taking into account factors of this kind, appears to be the most satisfactory method. This whole area, however, is one which requires constant study in order to make certain that the best qualified men are being selected.

Selection and Initial Training of Graduates

Final selection of college graduate candidates is based on careful interpretation of all the evidence which can be secured concerning each individual's character, abilities, and interests, in relation to the work for which he seems best fitted. Decisions are reached on the basis of personal interviews, faculty opinion, and appraisals of past performance in college, previous employment, and, where applicable, military service.

Each of the Bell companies conducts an initial training program for recent college graduates. These consist primarily of a series of rotated work assignments rather than of observation and classroom study—although those methods are used to some extent as seems appropriate. These assignments, of course, frequently involve specific training which is given to all employees undertaking that work. In some of the Operating Companies, assignments are interdepartmental in order to provide a broad background of knowledge of the company's activities. More frequently, in the Operating Companies and in the Western Electric Company, following a brief orientation period, these assignments are within a specific department for the work of which the individual candidate seems best fitted by interest and training. With opportunity in every department, his future progress, of course, will depend on performance and merit.

In a number of the Companies, non-college employees who have shown special ability warranting consideration for promotion are included in the same initial training program.

Bell Telephone Laboratories has established a training program for its young engineers entering the development departments which provides classroom instruction of graduate level in communications technology, accompanied initially by rotated work assignments. The length and character of an engineer's participation

Kearny Works of the Western Electric Company, manufacturing and supply organization of the Bell System depend on his aptitudes and interests and the current needs of the development program.

Employment of Women

ALTHOUGH some of the points which have been discussed are applicable both to college men and to college women, the number of college men employed and the organized activity which has gone into their employment program have been substantially greater than in the case of the women. However, as a result of expanding opportunities in the Bell System for college women, a number of the Companies have organized campus recruiting for them in recent years. It is anticipated that there will be an increasing need for able college women in the System companies.

THE COLLEGE EMPLOYMENT PROGRAM of the Bell System companies illustrates the broad principles that all appropriate sources of personnel should be used to secure those best qualified for their widely varied activities, that those from each source should be assisted to develop to their fullest capacity, and that promotion of those from all sources should be based on performance and merit.

Bell Telephone People Win Safety Award for Second Successive Year

Bell Telephone men and women have won for their companies the National Safety Council's top Award of Honor for the second successive year.

The latest award, covering 1952, is based on a 50 per cent improvement in the accident frequency rate, compared with the average for Bell Companies and the communications industry during the three previous years.

F. R. Kappel, vice president, Operation and Engineering, A. T. & T., said, "Bell Telephone men and women everywhere can be deeply proud of their achievement. . . .

"They did a fine job in winning the award for 1951. They did an even better job in winning it for 1952. In fact, their 1952 safety performance was the best in the history of the Bell System. . . .

"That is a splendid performance. It reflects the combined efforts of all the men and women in every department and branch of the System.

"We are able to work five times more safely than the average industry reporting to the National Safety Council. This clearly demonstrates the practical value of programs of accident prevention. Carefully planned job operations and approved procedures are both essential and effective in getting things done safely.

"Safety is good business. It reduces waste, suffering, heartaches and financial loss. We can never have too much of it. The more we have, the better off we are.

"This award not only does great honor to the men and women who have won it; I am sure it will also help us to make even further progress in the years ahead. And we shall all gain the benefit, for every contribution we make to the cause of safety works to our own immediate and personal advantage."

Twenty-five Years Ago in the BELL TELEPHONE QUARTERLY:
Volume VII Number 3, July, 1928

"The Honour of Kings"

By Frederick L. Rhodes

> *Mr. Rhodes joined the American Bell Telephone Company in Boston in 1892 as an engineer, and retired as outside plant development engineer of the American Telephone and Telegraph Company in New York in 1932. His death occurred the following year. His 40-year telephone career was devoted to the development of outside telephone plant, to which he made notable contributions. He was a studious and cultured man, and his books "The Beginnings of Telephony" and "John J. Carty—An Appreciation" are regarded as authoritative. The following statement, reprinted just 25 years after its original publication, is apt in conjunction with the article by Dr. Kelly which heads this issue.* EDITOR.

ALEXANDER GRAHAM BELL did not discover the telephone by haphazard. His invention was not an accident; it was a matter searched out. Before the first telephone was made, Professor Bell had formulated, in his mind's eye, the theory that electric currents, generated by a voice-vibrated armature in front of an electromagnet, could be made to produce electrical effects capable of transmitting speech. In the workshop of Mr. Charles Williams, Jr., 109 Court Street, Boston, on the second day of June, 1875, he confirmed his theory in the course of his classical experiments with tuned reeds, made preparatory to an experiment with multiple telegraph apparatus. When, on March 10, 1876, he said, "Mr. Watson, come here; I want you," and his words were transmitted over a short length of wire from his laboratory to his bed room, in the boarding house at No. 5 Exeter Place, in Boston, and faithfully received, a new era in communication unfolded.

Research and development, in the system which bears his name, began with Bell. There is a passage in the Book of Proverbs which seems particularly applicable: "The honour of kings is to search out a matter." That is what Bell did; it is what his successors are still doing. His name heads the unbroken dynasty of scientists and engineers whose efforts, through half a century, have nurtured the telephone art from its simple beginnings to the complex organism which today makes neighbors of more than a hundred millions of Americans and, spanning the Atlantic, links the peoples of two continents in the bonds of speech.

When the telephone was born, there was available for use with it none of the thousands of parts now essential to a far-flung communication system. Knowledge, of course, existed of certain properties of the metals, such as copper, iron, nickel, platinum, lead, antimony and many other elements and organic materials, which have subsequently been taught to play their roles in the vast modern telephone system; but until the matter of how to utilize them in the design and construction of such apparatus as cables, loading coils, repeaters and switchboards had been searched out, these substances were as far removed from practically useful telephonic apparatus as the words in the dictionary are remote from our classics of literature. The possibilities were latent; the human mind had not yet conceived them. And the touch of the artist was needed to search out the matter.

There were three ways in which the telephonic art in all its various phases might have been developed to meet operating needs. Each Associated Operating Company of the Bell System, acting by itself, through a large additional force of employees, and by retaining the services of physicists, chemists, mathematicians, metallurgists, designing engineers and other kinds of scientists and specialists, might have undertaken to develop its own methods, using its plant as an experimental laboratory (perhaps to the detriment of service to the telephone user) and to invent and design the new apparatus constantly required to meet the increasing and changing requirements of its business. Not only was new apparatus needed, but also the best methods for planning the growth of the plant, for installing it, for handling the traffic and for conducting every branch of the business had to be determined by trial and experiment, worked out, developed and made practically applicable. The art of telephony has always been continuously in a state of change and improvement. So rapid has been its growth and so radical its changes that the devices and methods of one period have been incapable of meeting the needs of the next period. If this plan (each company for itself) had been followed, much duplication of effort would have resulted and coördination of plant and practices between companies would have been difficult.

A second way would have been for each Associated Company to have done nothing to provide for its needs in respect of all these matters, hoping and trusting that there might always be someone, somewhere, who would be in a position to sell to it something that it could use in some way. Had this plan been followed, such improvements as came would have had to await the successful efforts of those outside the business of supplying telephone service and, consequently, less familiar with its demands and requirements than those more intimately connected with it.

The third way was for the Associated Operating Companies to employ a centralized organization, working all the time for all of them, to perform all of those things which could most effectively and efficiently be done for all, in common, by such a central institution.

THE GREATEST CREDIT is due to the founders of the Bell System for their vision in selecting the last of these three ways. The merit of their choice is evident when the efficiency of telephone service and the extent of its use by the public in the United States is contrasted with that in other parts of the world. From the beginning this plan has been a most important factor contributing to the expansion and improvement of the Bell System. A remarkable continuity has characterized its pursuit of the search for advancement by means of invention and experimentation, ever becoming better and better coördinated, as the years have passed, by the application of added experience in organization and administrative methods.

In this work the world's store of general scientific knowledge has always been utilized to the full, but the fact stands out that the fruits of pure research in the various sciences rarely, if ever, admit of direct application in telephony. Skillful development work frequently requiring years of patient effort by highly trained engineers and specialized technical experts is needed before some general conception can be translated and crystallized into a definite, improved piece of apparatus, system or method capable of practical utilization in the working telephone system.

The late Frederick L. Rhodes in 1927

The enormous strides in all branches of the physical and other sciences that the first quarter of the present century has witnessed have had an important reaction on the methods of conducting development and research work in the Bell System. In the early years, there was, literally, no profession of electrical engineering. Such knowledge of electrical theory as existed at that time was so incomplete and elementary that much of the experimentation and design could proceed only by "cut and try" methods.

FOR EXAMPLE, the production of an improved induction coil, in 1893, required a series of hundreds of experimental coils to be made, one after another, each differing slightly from the others and embodying the lessons learned from testing those which preceded it. Only in that way could such vital matters as the dimensions of the core and the best sizes of wire and numbers of turns for both primary and secondary windings be determined. At the present time, coil design has become much more nearly an exact science through the application of the greater knowledge that now exists of the physical laws of electromagnetic induction and of the values of the various electrical and magnetic constants which are involved.

New views as to the composition and structure of the atom and increasing knowledge of the behavior of electrons whose very existence was unsuspected comparatively few years ago, are placing new tools in the hands of the mathematical physicists of the Bell Telephone Laboratories and the Department of Development and Research * of the American Company. To these modern scientific discoveries they, themselves, have made and are making important contributions for, in many instances, it is becoming necessary to advance the frontiers of pure science and to solve baffling problems in fundamental research in order to lay the foundations for further advances in telephony.

No one can say with assurance what some of these advances will be. We only know that, when realized, they will contribute to a better and broader telephone service.

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* Combined with the Laboratories in 1934.

Who's Who & What's What

(*Continued from page 71*)

TERLY for January 1938 carried his contribution on the occasion of the twenty-fifth anniversary of the Plan.

After three years of service in the Navy as navigation instructor and navigation officer, John H. Page joined the Ohio Bell Telephone Company in 1946 as a traffic assistant. Various assignments in that department were followed, in 1950, by transfer to the Public Relations Department, where he was editor of a news bulletin and then of the company's *Ohio Bell* magazine. Since 1952 he has been information manager—a post enabling him to garner both the facts and the impressions he sets down in his contribution to this issue.

Starting with the Ohio Bell Telephone Company in 1920, Donald S. Bridgman transferred to the A. T. & T. Company a year later. Since then, in the Personnel Relations Department, he has been concerned with technical and staff employment, and in recent years has been responsible for coördination of the college employment programs of the Bell System companies. He is interested in questions arising in connection with military service of Bell System people, and his activities include arranging for inspection and study of the Bell System by visitors from other countries who come here in connection with government programs. He participates actively in the work of organizations which concern themselves with the general problem of the country's professional and technical manpower. The present is Mr. Bridgman's fourth contribution to this Magazine, his most recent previous one having been "Bell System Men and Women on Active Duty," in the issue for Summer 1951.

me XXXII · Number Three Autumn 1953

Bell Telephone MAGAZINE

Providing Employees with Information They Want
John W. Cogswell

Keeping Our Dispatch-Type Services Ever Ready
Robert H. Henderson

Building to Serve a City for a Little While
A PICTURE STORY

Recruiting Employees through Employees • Peter B. Howell and Clifford J. Hedin

Western Electric's Part in Offsetting Rising Costs
Howard G. Anderson

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Bell Telephone Magazine

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A Medium of Suggestion & A Record of Progress

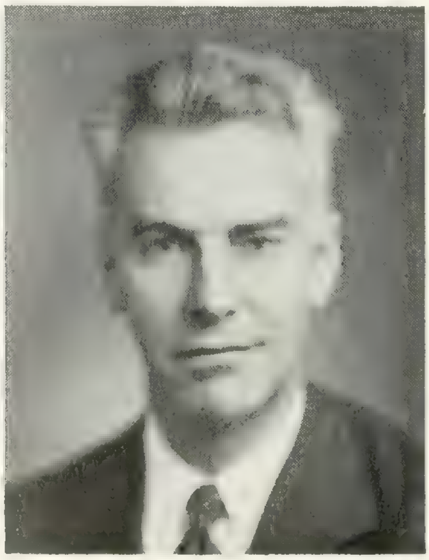
JUDSON S. BRADLEY, *Editor.* *Published four times a year for the supervisory forces of the Bell System by the Public Relations Department of the*
AMERICAN TELEPHONE AND TELEGRAPH CO., *195 Broadway, New York 7, N. Y.*
CLEO F. CRAIG, *President;* S. WHITNEY LANDON, *Sec.;* JOHN J. SCANLON, *Treas.*

Who's Who & What's What in This Issue

This issue's first article is also the first exposition of the philosophy underlying the present "point of view" concept of employee information. John W. Cogswell joined A. T. & T.'s Public Relations Department in July of 1952, with the title of employee information manager and the assignment of programming and coördinating employee information activities. In preparation of the article he had the help of his two information supervisors: Joy F. Hutton, who returned last July to The Pacific Telephone and Telegraph Company to carry on the same sort of work there, and Walter A. Lehnert, who remains with him in New York. Mr. Cogswell joined the Commercial Department of the New York Telephone Company in 1931, and served as representative and as manager in several communities in the Long Island Area until 1944. In that year he moved to the Upstate Area, where he held posts as district manager in Utica and Buffalo until becoming division manager in the latter city in 1949—the office he left to join A. T. & T. three years later.

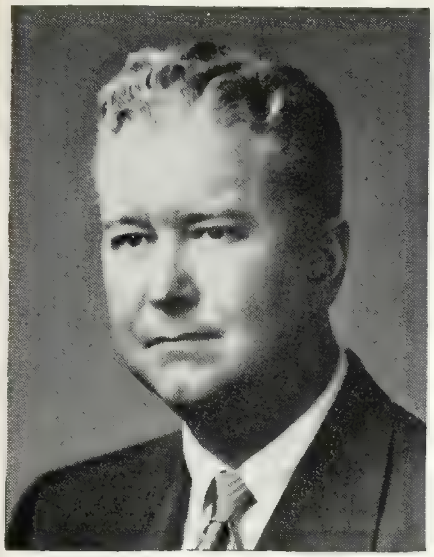
Special services often require special kinds of circuits, and Robert H. Henderson deals intimately with all kinds on the basis of his quarter-century career in the Long Lines Department and in the Department of Operation and Engineering of the A. T. & T. Company. He started with the former in 1924, and held assignments in New York and Buffalo before moving, in 1928, to the Long Lines general plant supervisor's organization in New York. In 1935 he was appointed supervisor of program transmission, and in 1940 supervisor of transmission maintenance methods in the general plant manager's office. Five years later he moved to the O. & E. Department of A. T. & T., and in 1948 became toll service engineer. Here he works with Long Lines and the Associated Companies on radio and toll service problems. Not only is he concerned with the types of cir-

John W. Cogswell



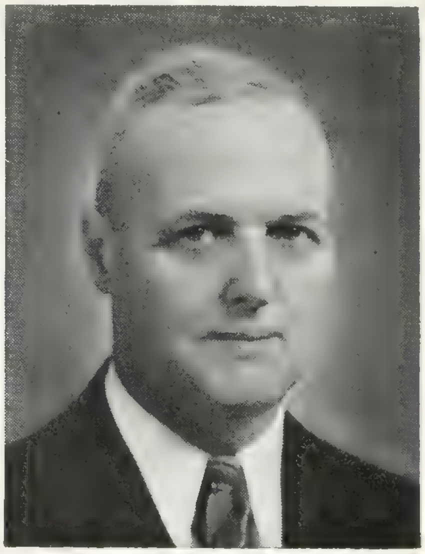
Robert H. Henderson

Peter B. Howell



Clifford J. Hedin

Howard G. Anderson



Ralph E. Mooney

cuits he describes in these pages but he has been involved with mobile radio telephone service since the Bell System entered that field in 1946.

COLLABORATION between A. T. & T.'s Traffic Department and "the field" has produced an article which gives both general and particularized views of the current problem of Bell System employment.

PETER B. HOWELL began his career with the New York Telephone Company in 1927 in the Traffic Department in the Manhattan-Bronx-Westchester Area. After various field and staff assignments, he transferred to the Long Island Area in 1941 as district traffic superintendent. He later became traffic employment and training supervisor, and supervisor of employment when the hiring of all women was centralized for the area. Mr. Howell has been in A. T. & T.'s Traffic Division since October 1945, where he has held various assignments associated with recruiting, employment, induction of new employees, training, the reduction of force losses, and, for a period, operating practices. Much of his time is spent in the field, working with the various companies in connection with their recruiting, employment, and force loss problems.

CLIFFORD J. HEDIN was assistant statistician in the Minnesota Area Accounting Department of the Northwestern Bell Telephone Company when he was given the assignment of organizing the employee recruiting program in Minneapolis and St. Paul late in 1952. He started with that company in 1924 as a groundman in the Construction Department, and in 1929 transferred to the Accounting Department, where he held various supervisory positions in Omaha and Minneapolis. At present he is supervisor of employment in the Minnesota Area Traffic Department.

AN EDITOR AND WRITER in Western Electric's public relations organization, HOWARD G. ANDERSON is responsible for preparing and circulating informative articles about the Bell System's manufacturing and supply unit to public relations men and women of the Bell telephone companies. His introduction to the writing trade was as a newspaper reporter in Allentown, Pa., where he spent much of his time preparing feature stories about the colorful inhabitants of that "Pennsylvania Dutch" community. After a three-year tour of duty as gunnery officer in the Navy, he moved to California for five years of public relations work in the medical field. On a trip East, he found Western Electric during his absence had built a manufacturing plant in Allentown that was an industrial showplace of the Lehigh Valley, and promptly decided he wanted to remain and join Western Elec-

(*Continued on page 185*)

New warehouse buildings and more efficient methods of handling telephone materials, such as this "straddle stacker" lifting a palletized load, are helping Western Electric overcome some of the effects of inflation. See the article beginning on page 170

"Point of View" Is the Vital Element in an Information Program which Will Give Telephone People the Facts They Are Entitled to Know about This Business

Providing Employees with Information They Want

John W. Cogswell

THE OPERATOR looked her chief right in the eye and calmly asked, "So what?"

There was a pause, while the chief operator got adjusted to this abrupt hitch in her presentation of the Annual Report. Then she replied, "Why, it's important. It's the report card on our business. Our jobs, our benefits, our futures are wrapped up in it."

"But what can I do about it? What if I didn't like something? Would that make any difference?"

The chief operator tapped her pencil, troubled. There was an answer, but she couldn't put it into words quickly for this outspoken youngster. Chances are she sighed and tried to get back on the subject. But it was hard going, because her line of communication had been snapped.

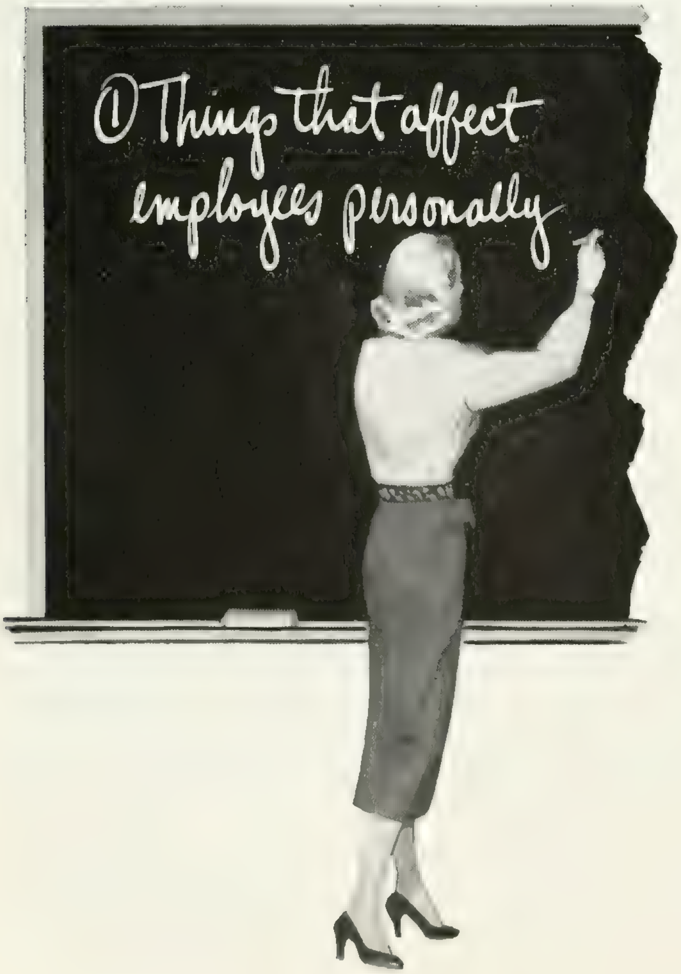
We do not mean to present the chief operator in a poor light, for, in all truth, she could have been any one of us, in any department. But the questions the operator raised are basic. What kinds of information *do* employees want? Who does care? Why? How important is it? Does it make any difference?

Any employee, no matter how long he is around, absorbs a good deal of general information about the business over and above the specific details of his job. This experience factor builds up for the individual a personal pattern of knowledge and understanding. It emphasizes the fact that no single project can adequately do the employee information job.

It is natural to be concerned about the feelings employees have about the telephone business, and the way they pass them on to others. You want those feelings to be loyal and favorable, but such a reflection doesn't come automatically. *You have to* *earn it,* by the things you do and the things you say.

The main interest here is in the things that are said, the planned information that people receive. Is it effective? Are they getting as much as they want? Is the best possible job being done?

Our expressed intention is to let employees know what's going on in the business; what the problems, plans, and accomplishments are. To do this, certain information is added to the informal experience stream we have described. In the case of the young operator, this effort entailed careful preparation and appropriate visual aids. It was in line with a perfectly sincere management conviction that a clear understanding is to the employee's interest as well as the company's.


① Things that affect employees personally

But the employee said, in effect, "That's got nothing to do with me."

You might retort, "She's young. She's fresh. We can forget her. She's got a steady boy friend and won't be with us long."

You would be sadly wrong. This girl will be with us as long as she lives. She will be a moving, talking unit of our society, with full right and plenty of will to express herself. She will be an authority on telephone matters because she worked for the telephone company. And her opinion will carry weight with her family, other customers, friends and neighbors. If you dismiss this girl as an isolated case, without investigating further, you are plunging your head deep in the sand.

Let's go back to that little meeting. The chief operator talked. She said, in effect, "Here is something significant to you. Please listen."

Obediently, the girl listened. In the majority of cases, that would have been that. But not this youngster. She never heard of "two-way communication," but she felt entitled to her say. So she talked back.

"There are two sides to this," she implied.

Values of Two-Way Communication

THE RESULT left the chief puzzled and disturbed and a little hurt. No one likes his good intentions to get trampled flat. But her state of mind can improve if she realizes the girl did her a favor.

For what she said amounted to "You assume I'm interested in big figures and percents because you are. You act disappointed and indignant when I'm not. You'd have saved a lot of work if you'd taken the trouble to ask me first."

Hmm. Was she asked? Did anyone take the trouble to find out what she and all her co-workers in Accounting and Commercial and Plant wanted from their side? In all honesty, probably not. There was a great deal of talking being done but not very much listening.

Yet, all of us are vitally interested in having the work experience of employees form for them a favorable opinion about the company. It is not reasonable to expect this job satisfaction unless their ideas are taken into account, too.

Let's heed the operator's suggestion and take a good look at the other side. Let's say to her and all her fellow-workers, "Please tell us what you would like to know about the telephone business."

Actually, this has already been done in a few Bell System companies. While more information is needed, what has been learned all points in one direction. Overwhelmingly, employees first want to know about the close, personal things which touch *them*. They are, in fact, no different from any other human beings on earth.

A realistic analysis of Employee Information must recognize this basic truth: never lose sight of employee self-interest in any informative effort we make. Let's go over to the nearest blackboard right now, print a large number "1" on it, and write:

"Things that affect employees personally."

The customer opinion studies that have been conducted for a number of years show that this business enjoys a great deal of public trust and confidence. We are coming more and more to realize how much of this is due to the part employees play as living testimonials to our good service, good citizenship, and good employment.

What Is the Employee's Role?

BUT HOW MUCH is really known about their part? What questions do friends, acquaintances and customers ask employees? Do they have the answers? Do they need or want any help in this direction? What are their understandings and misunderstandings? Do they have doubts?

Some attempts have been made to get the answers to these questions by interviewing employees. While more studies are needed in this significant area, the few that have been made agree in their conclusions. Employees do talk often to others about the telephone business. They are asked most frequently about service, charges, and employment. And the majority of those interviewed said *yes,* they needed help to answer fully the questions they got.

It's time to go to the blackboard again. After the figure "2" let's add:

"Subjects friends or customers are interested in hearing about."

Employee Information has been looked at now from the employee's view and the customer's view. Is there anything else?

What about the company side? To pay attention only to what employees say they want would be

(2) Subjects friends or customers are interested in hearing about

just as one-sided as the example we started out with. The employee has no way of knowing about many kinds of information—new developments, particular progress and results, future plans, and so on. How can he or she express a desire for them?

Obviously, however, any employee has some degree of interest about what's going on in the business, if only because his or her welfare is for the time being tied up with the company's. Few human urges are stronger than the yen to "be in the know," and even if he or she hasn't expressed a need, management has an obligation to see that the story is offered.

So the list cannot be complete without a third point on the blackboard:

"Useful background information, whether or not the employee has expressed a need."

Information Must Be Available

Underlying the three points already listed on the blackboard is another important factor. Whether or not information is given out, or the employee asks for it, it must be perfectly clear that it is always available. Employees have no incentive to be good public representatives unless their experiences within the business make them *want to.* And if the employee knows that when he wants an answer he can have it—and his experience consistently backs this up—then you have gone a long way toward your objective of earning his respect and loyalty.

Let's print "Availability" across the bottom of the blackboard, and emphasize it.

Now, we believe, you have an outline for the fundamentals of employee information. The best judgment of people within and without the business, as well as every scrap of valid study data available, supports this conclusion. It can be expressed in one sentence this way:

Employee Information is that part of the continuous development of an employee that satisfies his wants and needs for a greater understanding of what goes on in the business.

If all three elements—the employee's desires, the public's desires, and the company's desires—had been present *in proper proportion,* the young operator would not have thrown a monkey wrench into her chief's presentation.

With this understanding, what is the most practical way to put this basic approach to work? Is it really as simple and clear as it seems? How far is it between those words written on the blackboard and the young operator in the workaday atmosphere of her office?

If you, as a supervisor, agree that the evidence is plain and the conclusion reasonable, could you start tomorrow helping other supervisors put it to work? Could you deal with the questions you would inevitably get from them? Could you make such a viewpoint stand up in the day-to-day life of our business?

How Do You Go About It?

The first question they would be likely to ask you might well be the $64 one: "The approach sounds reasonable, but how do you go about doing it?"

Well, it's obvious that no concept can earn a place in our business unless it will fit the pattern of our normal operations. So you'd be on safe ground to answer the question with, "Just like any new practice."

"That means along existing channels, then?"

"Right," you reply, "Like induction and training, and day-to-day supervision."

"Now let me get this straight. You want the information in these activities to reflect what employees are interested in as well as what management wants them to have?"

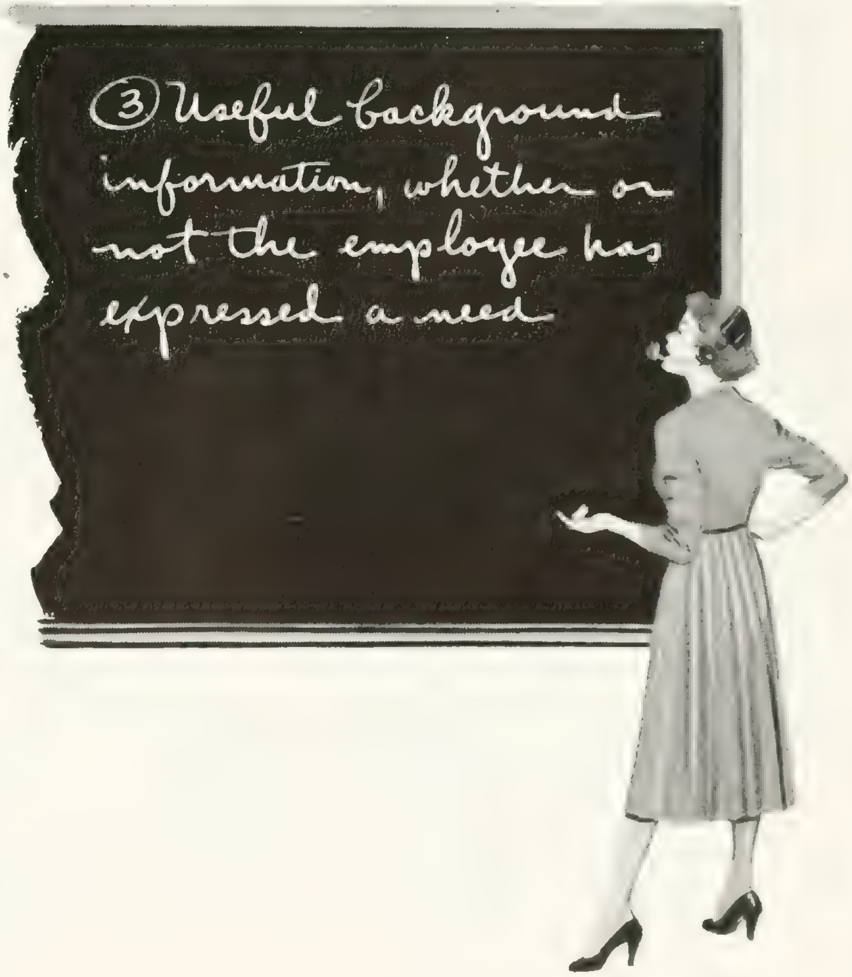
"Yes." You realize that leaves out a thing or two, but it's the main idea.

"That means we have to be sure about what employees really want?"

You nod.

"But don't we know that already? Aren't we passing out information all the time?"

"Sure. You may be doing exactly what we're talking about. But," you point out, "there are many indica-


③ Useful background information, whether or not the employee has expressed a need

tions that not everyone is doing it." And if you have sat in on a non-management meeting and heard people discuss freely what they want to know, you would be able to back this up with plenty of specifics.

"Hmm," muses your friend. "Well, all right. I guess I can see what you're driving at—fit it into our normal operations. Will that do it?"

When you realize how powerful informal channels of communication are, your own experience will lead you to reply, "Just fitting it into normal operations isn't enough. Supervisors in their day-to-day contacts do a lot of talking about the business. If they don't have the employee information point of view, the material they pass along isn't likely to take. We've all had to become safety supervisors, haven't we? Why not information supervisors?"

"Now, wait a minute," says your friend in alarm, "We're up to our ears already."

"You took on safety, didn't you?" you ask.

"That's different. That's tangible. You're talking now about something much harder to pin down. A long-range thing."

At this point, you get a bright idea. "How long," you ask, "has safety been going on?"

"I don't remember, exactly."

"The idea was started about 1916. It shaped up in the nineteen-twenties. Our safety creed was coined in 1937. Wouldn't you call that long range? It's over thirty years."

"Well, yes. But somehow I can't get this information function down to earth, the way I can safety. Can you give me an example?"

"I just did," you say calmly.

"You . . . what?"

"I gave you some history on the safety program, so easily and naturally you didn't even realize you were getting information. I didn't make a big deal out of it. I just took advantage of an opportunity. Timed it, too. Six seconds."

It's a Point of View

There may well be a thoughtful pause. Then your point is apt to be played back to you in some such way as this: "You mean never losing a chance to pass out some background or explanation, as long as it fits at the time. You're really talking about a *point of view."*

"I guess I am."

"But I think I have that point of view now."

"I hope you do. If so, your results should reflect it, and others ought to know about it."

Even so, if this supervisor, or another like him, were to sit in and listen to employee comments freely expressed, chances are his views would alter.

He'd hear that many employees tend to retain information better if it is given to them orally. That people lose confidence in supervisors who don't seem to have the answers. That they don't understand some things we take for granted. That employees prefer simple, clear, one-at-a-time explanations. That employees are eager to make suggestions that may help with company problems. And finally, he'd feel the real enthusiasm that such meetings generate among both employees and supervisors.

When you say that oral information is much better, more effective, than written, don't forget that written is the basis of all our effort and can never be replaced. But an informal, face-to-face contact is usually much more compelling than the lecture or "telling" kind. Why? It is warm, it is personal, it allows for two-way movement of questions and answers and ideas.

It can be elaborately described in terms of identification, recognition and participation, in terms of the anecdotal rather than the rational approach—but all that really means is that human beings are more interested in themselves and other human beings than anything else on earth. And when you take advantage of that fact you can't help but be heard.

Self-Interest Is Powerful

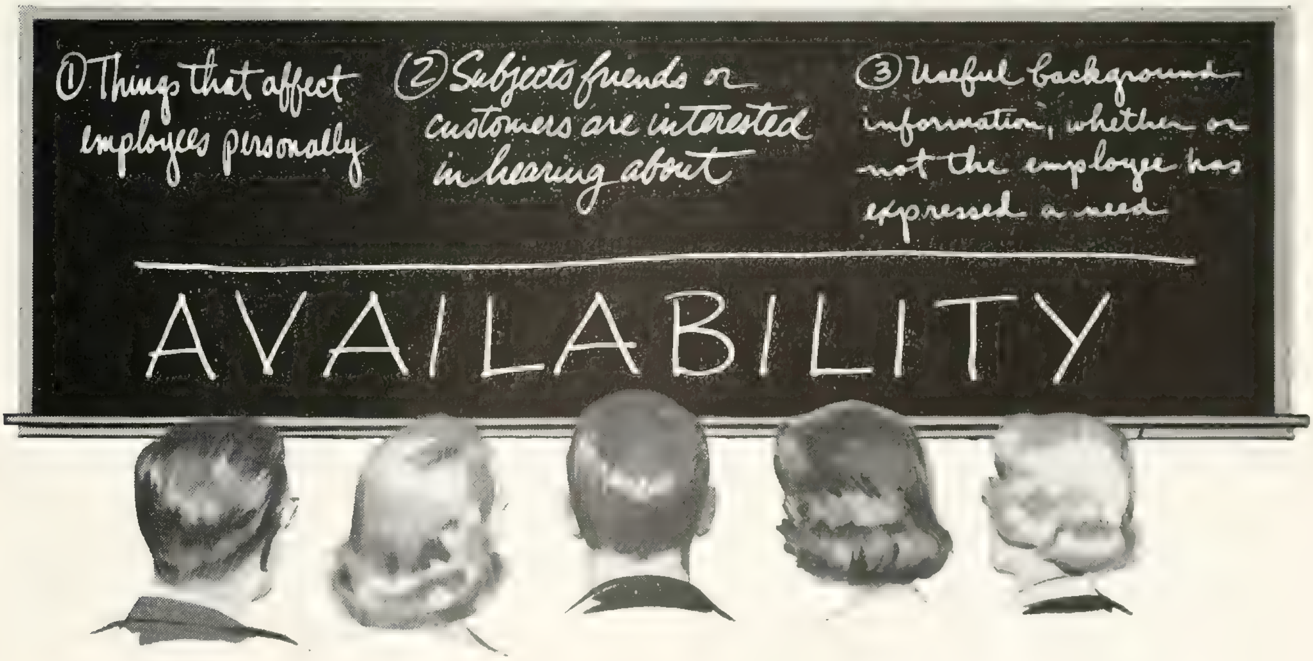
We all know, also, the power of self-interest. You read about a flood control project authorized back in Washington, D. C. Interesting, but hardly something to bring you out of your chair. But a few months later, when a government bulldozer chuffs up to *your* property line . . .

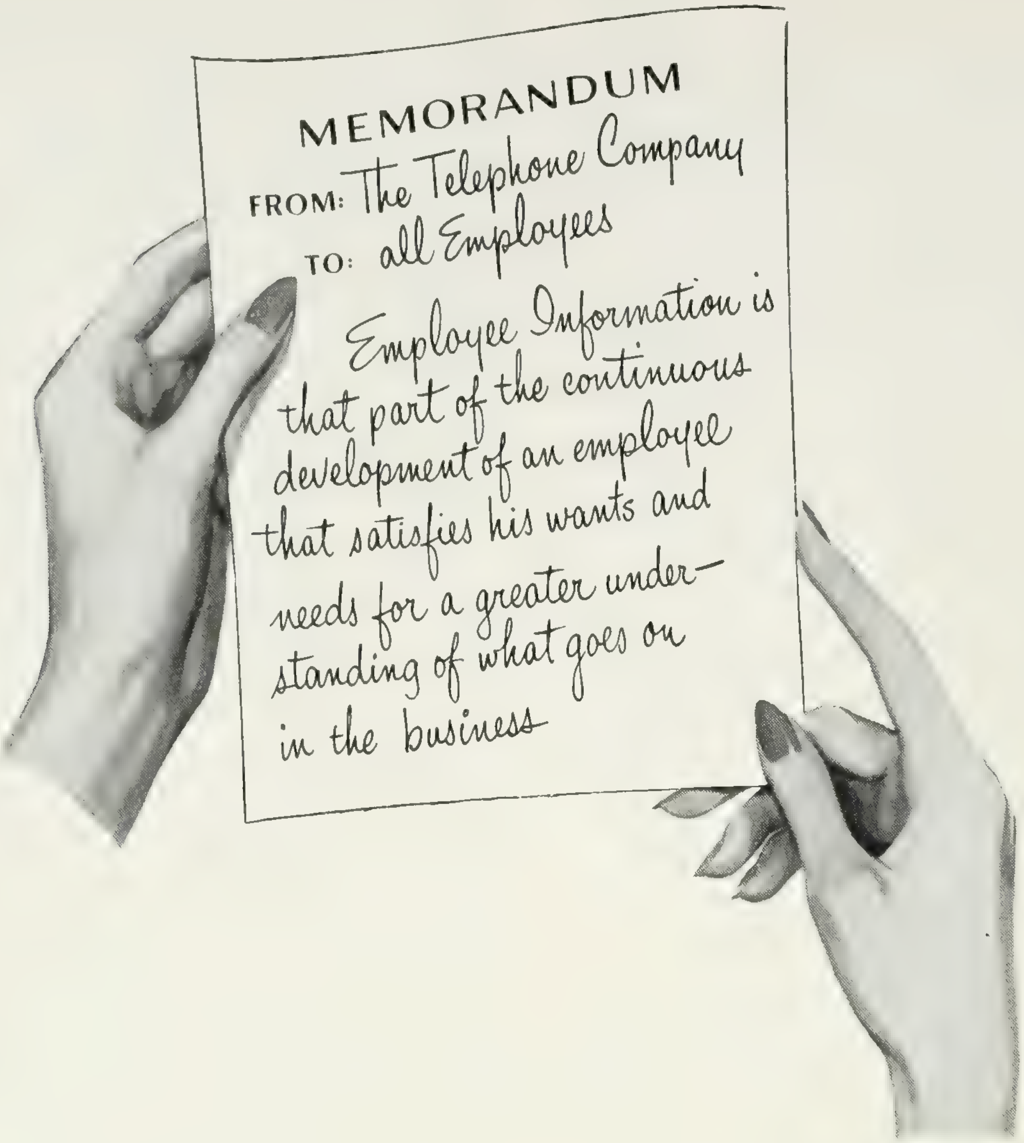
What is the practical way to put this point of view to work? Take the young operator, who heard about a rate of return expressed in percent of total capitalization aggregating hundreds of millions of dollars—about a financially healthy telephone company—something about stocks and bonds—and she backed away from this kind of information.

She's a toll operator. To her, the world of business finance is quite remote. Her day is crowded with cords, keys, toll tickets, and all the fascinating experiences of bringing people together at the switchboard. Including those who don't seem to know the number they're calling.

Wait—how about that as an idea?

She has heard a lot about the call-by-number program. She places calls for some customers who don't have the number they want. She knows how circuits are held up while the number is being found—how much additional work is required by Information and other operators. She's


① Things that affect employees personally
② Subjects friends or customers are interested in hearing about
③ Useful background information, whether or not the employee has expressed a need
AVAILABILITY



MEMORANDUM
FROM: The Telephone Company
TO: all Employees

Employee Information is that part of the continuous development of an employee that satisfies his wants and needs for a greater understanding of what goes on in the business

fully aware of what her company is doing to improve call-by-number performance. The whole subject is as close to the operator as her headset.

This ought to be a "natural"! How about the dollars in circuit time and the services of other people required on calls not placed by number? It's expensive not to encourage calling by number. Such expense is a big item in the company's year-round operations. It's here—in the Annual Report—and one of the items we must allow for in the rate structure.

Call-by-number is a familiar subject and right here at the switchboard less than a cord's length away are the means to relate the company's operations and financial health to it.

But you don't do all the talking. If necessary, you bite your tongue to avoid it. Because there are two sides to this thing, and she has some questions, and some opinions, too. And you are now committed to lean over backwards to give her a chance to participate.

When you are through, she says, "Gee, I didn't know all that." Or, "That's interesting." Or, "Now I see why." Perhaps—because, after all, you have been answering questions she raised—she says, "Thanks," and really means it.

Why shouldn't she? This talk has

tied into her day-to-day work. It will enable her to answer questions her friends might bring up. It has been clear enough for her to understand while holding her interest. It has enabled her to take part in one of life's most satisfying experiences—a sharing of ideas and opinions. She has learned something more, perhaps, about the background of the call-by-number program. She has also learned—without even being conscious of being told—something about good management judgment and the company's approach to one aspect of its rate problem.

Is she likely to say "So what?" now?

Or take something the operator herself has expressed an interest in. Once she asked you about promotions. Promotions are related to a large degree to the growth of the business. The last few years tell an impressive story. So will the next few—assuming the company attracts the capital for the new equipment needed for growth. The ability to do that is tied directly into the financial health of the company. In answering her question, you are telling her much of the story contained in the Annual Report. Perhaps you don't even mention rates directly. But the point is made in a reasonable and natural manner. And, best of all, she is learning that the information is readily available to her.

This kind of communication doesn't fail. It is what is meant by understanding and using Employee Information to its fullest advantage. It means making sure you know what the employee really wants and needs, then filling those desires promptly, clearly, and completely.

When expressed as a continuing point of view by the supervisor, and supported consistently in written material, this has a striking effect on morale. In the last analysis, what is more important to the public relations or the productivity of the business than the morale of the people who are its greatest asset?

Many Thousands of Little-Known Circuits, Performing Unusual Tasks of Special Importance, Need Extraordinary Measures of Protection and Maintenance

Keeping Our Dispatch-Type Services Ever Ready

Robert H. Henderson

FEW PEOPLE, even in the telephone industry itself, realize the broad scope of the services furnished by Bell System companies. The first thought is of the telephone as it is encountered in day-to-day living, where lifting the instrument brings the familiar "number please?" or the dial tone. Yet besides this universally recognized service, there are hundreds of thousands of almost unknown circuits and channels furnished by the telephone companies the country over.

Probably the least well known of these are what have been called "dispatch-type services." They are different from your home or business telephone in many ways. The biggest difference is that these particular services do not, in general, connect with other Bell System telephones. In fact, many of them do not even have a telephone or any other Bell System equipment at the customer's office. Each is designed and engineered to fit the customer's requirements, whatever they may be, and protection and maintenance are then built around each circuit, following the general patterns that have been evolved. But always the customer's special problems and service requirements are kept in mind.

Such dispatch-type services cover a broad range of uses. Some—the pipe line networks, electric power grids, and railroad system services—were described here in a recent article.* The others are equally important to us all in our day-to-day lives, but they may not be as well known.

Among the latter are the various services for the Armed Forces, including the facilities in the Air Defense Command and Strategic Air Command networks which would be used to alert our defense forces for

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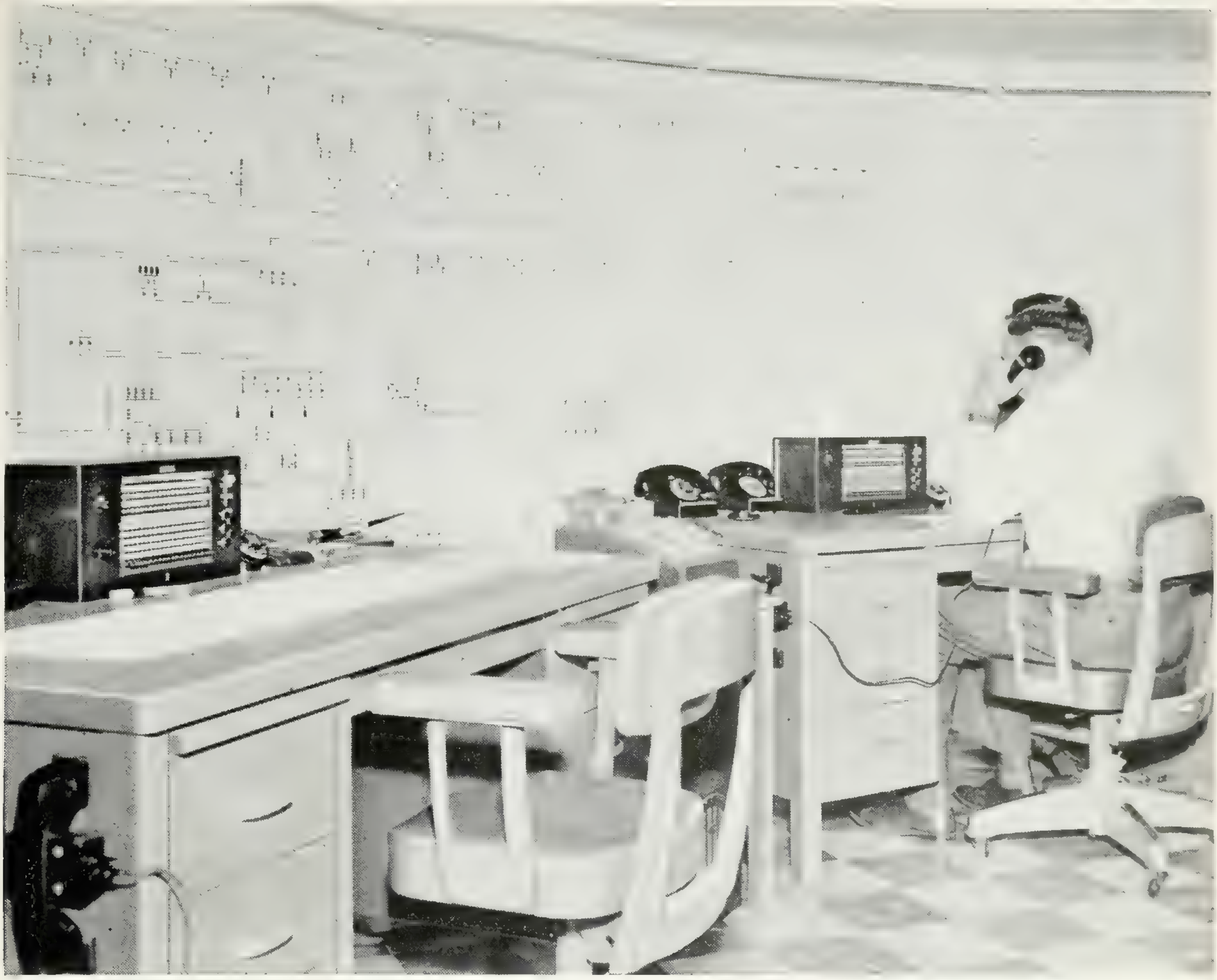
* "Communications for Right-of-Way Companies," MAGAZINE, Spring 1953.



Load dispatchers' boards controlling large electric power distribution networks have supervisory control circuits, telemetering circuits, and talking circuits to important generating and switching stations

warding off attacks and retaliating against an enemy. Some connect radar search locations—constantly on watch for approaching planes—with their direction centers, interconnect these direction centers, and connect them to the filter centers that plot the location of all planes spotted. Others interconnect these filter centers, to assure coördination, and connect some of the civilian airplane spotters at observation posts with their filter centers, to facilitate reporting of plane positions. Still others connect these strategic locations to various echelons of command.

Another group stand ready to transmit the command "Scramble" as waiting pilots and planes are alert to take off and intercept any plane not properly identified. Anti-aircraft artillery command locations are also connected with their batteries and their spotting locations, and other circuits connect them to the air defense direction centers.

Emanating from the Air Defense Control Centers are the Civil and Military Air Defense Warning networks, which are designed to alert the public and those responsible for their safety. Among these are cir-

Pipe line pumping stations, impressive and often remote installations, receive operating instructions from their dispatchers over specially designed telephone circuits

cuits to Civilian Defense headquarters locations in key cities, and the "Bell and Lights" circuits that disseminate the warning from these points to other communities and to important industrial and governmental units within the community. Such important links in the defense chain as siren control circuits and the entire Civil Defense wire line network are included.

Equally important dispatch-type circuits which have for years played a very important day-to-day role in the lives of many are the various services we furnish to the Civil Aeronautics Administration, which continuously guard the air lines so many Americans travel in complete confidence.

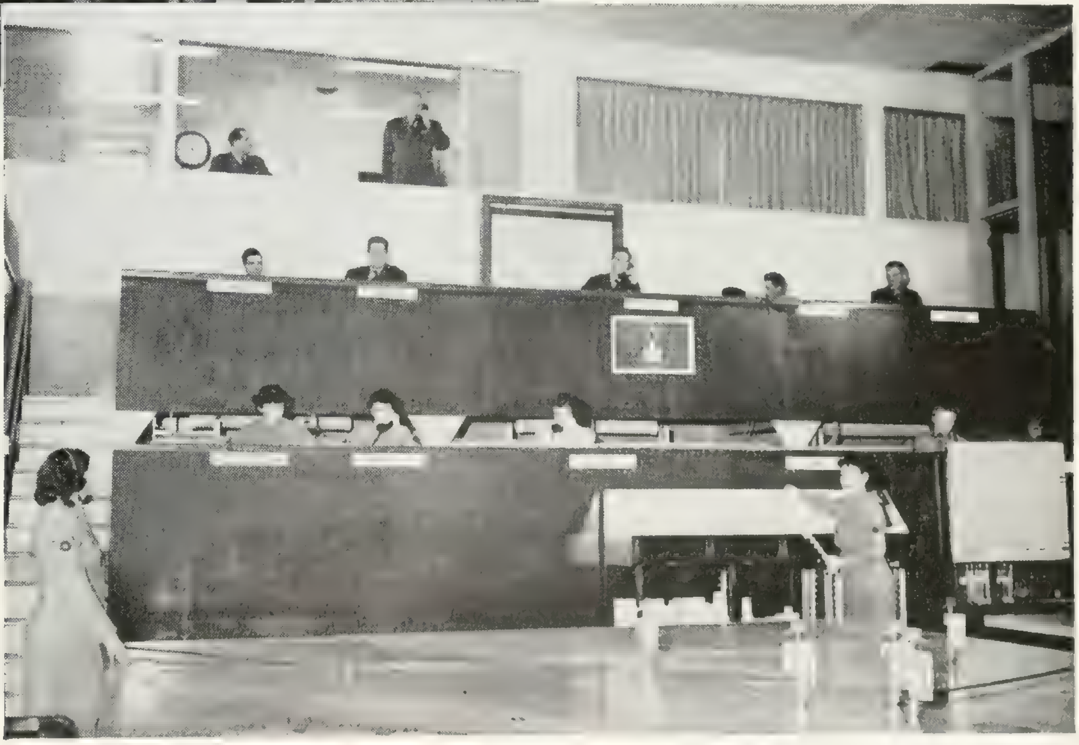
C.A.A. teletypewriter circuits spanning the country collect basic weather data. After it is analyzed and assembled, significant weather information and maps are transmitted to airports, where they serve for the guidance of pilots. Specially designed telephone circuits are used to transmit flight plans and coördinate and control the movement of planes in flight. Also in this category are the circuits to omnirange and other radio beacons and those connecting controllers to the radio transmitters linking them with planes in flight.

Even so brief a listing as this confirms the earlier statement that "dispatch-type services" have a significance for all of us which is far greater than is appreciated by any save those immediately "in the know."

Where They Go

THIS WIDE VARIETY in the kinds of "dispatch-type" circuits and services is only part of the story. The circuits vary greatly in length. At the one extreme is a simple talking circuit perhaps connecting a power dispatcher on one floor of a building with a man who can operate switches on another floor of the same building. At the other may be a far-flung "party line" circuit that connects a pipe-line dispatcher in Texas with "gathering points" in that area and compressor ("booster") stations along the way and with distribution or sales points perhaps 2,000 miles away. Again, there are circuits that

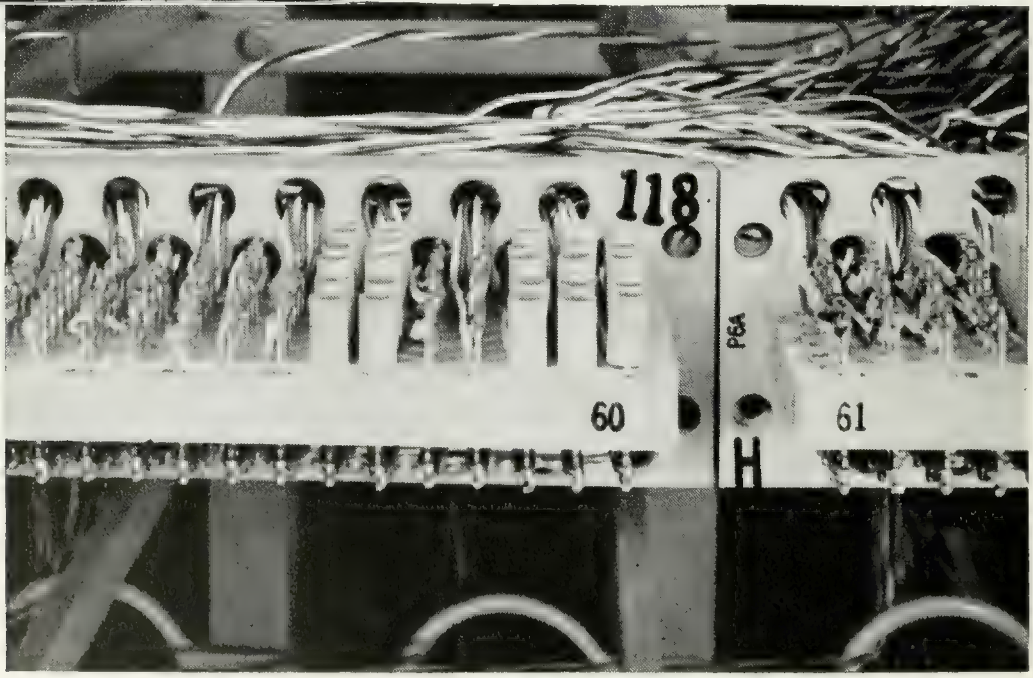
Left: Anti-aircraft gun positions such as these are connected with command and other locations by telephone circuits. Below: An Air Defense Control Center in operation as the General prepares to send out an alert



by means of pulses or spurts of current will read meters a short distance away, and others that by means of similar signals will open and close valves or start and stop motors hundreds of miles away.

The points served are scattered from one end of the country to the other, and in many parts of Canada as well. All manner of places are included: swamp and desert, city and wide-open prairie, mountain top and power dam, remote Armed Forces bases whose very locations are "classified" information, and metropolitan air fields. Some locations are reached only by radio or by a long open-wire line, while for others in highly developed areas there is a choice of many routes. Conditions at these spots also present great contrasts: a comfortable business office, the noisy control tower at an airport, a pumping station where the atmosphere is explosive and the slightest spark would spell catastrophe, an Army installation where the maintenance people must receive government clearances before they are permitted to work.

All these circuits have one thing in common. They must be ready for immediate use whenever they are needed, and they must be free from interruptions and interference. Tele-



Above: Guards placed over protectors and heat coils and split sleeves on terminals of dispatch-type services at a main frame. These terminals will be avoided in routine line insulation testing. Below: Split fiber sleeves on terminals at a distributing frame to prevent accidental contact while working on adjacent terminals phone people everywhere keep this goal constantly in mind and strive to achieve it—in spite of the elements, occasional human error, and equipment failure.

How do we go about trying to meet this objective of keeping all these circuits constantly ready for customers' use? There are three keys to this: *protection, preventive maintenance, corrective maintenance.*

Protection

With telephone lines and cables, as with highways, there is usually more than one route between two points and frequently there are several. If a customer has several services between two points, generally some are routed over one of these voice highways and—as a precaution against any sort of tie-up—the others are sent over another voice highway. In any case, plans are made in advance of trouble to reroute or detour each service to another "highway." This is one general form of protection.

Buried and underground telephone cables require protection of a special kind. After these cables are plowed into the ground or placed in conduit, there is no visible evidence of their location, and they seem to be fair prey for all manner of people who are set on digging. Operators of trenching machines and earth moving machinery, oil well drillers, farmers setting fence posts or laying drain tile, highway crews driving markers or doing road construction work, gas and water companies laying pipe—all seem to be drawn toward these cables as iron to a magnet. Preventing damage to the cables and avoiding interruption to the circuits in them is a never ending task.

When underground cables are first run, signs and markers are placed at highway crossings, property lines, and other vulnerable points. Regular visits are made to property owners whose land they cross, requesting them to notify the telephone company before starting any work that might result in damage, and similar visits are made to contractors, highway department officials, other utilities—in short, anyone who digs regularly. Bureaus that issue digging permits are provided with rubber stamps which suggest that contacts be made with the telephone company before digging operations are started.

Some men spend their entire time going back and forth along cable routes, watching for any activities that might cause trouble. In some hard-to-cover areas where there is a great deal of digging activity, airplanes make regular flights over the routes of some cables, watching for potentially damaging operations.

Protection inside telephone offices is as essential as the protection of cables. Much of this starts with the office records that show the assignment of individual services. The records carry special notations and warnings regarding dispatch-type services. These constitute a very important type of protection, as they warn anyone having occasion to consult them of the class of service and the special precautions that must be observed, and are the basis for the protection given these services in the telephone offices.

Every circuit or service is usually made up of a number of components.

Every terminal of each component in the office and at the many cable terminals along the cables, and every "testing jack appearance" of the circuit in the office, is a potential source of interruption, so these various appearances must be protected.

Use of Special Guards

THIS PHASE of protection consists broadly of covering these various terminals and jacks with guards, to prevent accidental contact with them and to warn workmen that these terminals or jacks carry circuits that require special precautions. These guards take a variety of forms and have been designed to fit snugly; but they are also designed to be removed quickly when tests must be made or the circuit must be rearranged. Distinctive colors or shapes are often used to carry a message to the tester.

The question may well be asked, "Why single out some circuits for special protection? Aren't all telephone services and circuits important?" Of course all telephone lines are important, and all telephone employees know it! Certain testing techniques, however, are entirely satisfactory for some services and not for others. The special protective measures take into account the special requirements of dispatch-type and other selected services and are not unlike the "stop street" and other traffic signs along the highways. A "Stop. Proceed with caution" sign is quite appropriate on some of these services, where accidental interruption could prevent the transmission of a signal or result in a false signal to equipment controlling some power system or pipe line operation—or at least cause a considerable amount of confusion.

Preventive Maintenance

MANY PARTS of the telephone plant require regular attention, to assure that they are working at their maximum efficiency—or to restore them to that condition. Some of these operations are simply routine preventive maintenance, and are designed to anticipate causes of service interruption.*

Your telephone service uses some facilities that are provided for your exclusive use, and some that are shared with many others. Your telephone instrument itself and the pair of wires that connects it to the central office—if you have an individual line—are in the former category. In the latter are included some of the switching equipment at the central office known as common equipment, the trunks between your central office and others, and the various toll or long distance circuits you may use occasionally. Even the pair of wires assigned exclusively to you is in use less than the entire 24-hour day (though you may sometimes question this), and in between calls it can be "borrowed" for short periods for routine maintenance checks without interfering with its normal use. The same is true of the common equipment, the trunks between central offices, and the circuits between cities. Some of these can be removed from service for hours at a time for routine preventive maintenance checks of one sort or another without causing any telephone user the slightest inconvenience.

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* "Finding Troubles before They Happen," MAGAZINE, Winter 1952–53.

Warning markers have been placed along the cable route, and a telephone man stands by to assure that the digging is carried on without damage to the buried cable

Now let's take a look at the dispatch-type service customer. All of the facilities provided for him are provided for his exclusive use. There is no common equipment in a central office that helps him on demand and then is free to serve someone else, no long distance circuit between cities that may also be used by others. There is no chance to "borrow" these dispatch-type circuits for short periods for preventive maintenance activities—at any rate, not without obtaining the customer's permission in advance.

Special service or no special service, however, preventive maintenance is necessary. In fact, to help assure continuity of service is perhaps particularly important on these dispatch-type services. How can these limitations on the activity be overcome? The various protective devices used on these circuits serve as a red warning flag to the maintenance men that special maintenance procedures are necessary.

When line insulation tests are made, for example, other pairs give indication of the condition of the dispatch pairs so the latter can be skipped. When tests and adjustments must be made on long intercity talking circuits, with their many intermediate repeaters, another similar circuit can be substituted temporarily without interfering with the customer's service. There are instances, however, where this sort of thing is not feasible: on control circuits, or when signaling equipment or other such equipment at the customers' office is involved. Then the customer's coöperation is enlisted, and the work is done during a normally quiet period; or men stand by, ready to perform the functions otherwise performed by the equipment or the circuit. The continuity of service must be maintained, by whatever expedient.

Warning Flags

SOME PREVENTIVE maintenance involves working at points where there is no "stop street" sign or red warning flag. For example, in heavily built-up areas, an underground cable may be damaged over the years by electrolysis, and it may become necessary to transfer all circuits to a new section of cable. This entails individually identifying each pair, in turn, at the splices at the ends of the section and substituting a selected pair in the new cable for the pair in the old cable. When minor disturbances incidental to this work could interfere with a customer's service, every attempt is made to notify him so that he too can take whatever precautions appear desirable.

Telephone facilities of all sorts are in a continuous state of change. People are constantly on the move and telephones must be disconnected and reconnected. New cables are being placed, old cables extended, and central offices are being expanded or rearranged in an effort to keep up with the desires of customers for more and still more telephones. All of this means constant activity of one sort or another in just about every part of the telephone plant. These additions and rearrangements could mean possible serious trouble—were it not for the protection that has been applied on frames and in cable terminals warning workers of the presence of these dispatch-type services and protecting them from accidental contact.

Corrective Maintenance

THIRD OF OUR specific topics, *corrective maintenance,* involves fixing the troubles which do happen. Here is where all our advance planning pays off; because—in simplest possible terms—when the difficulty has been located, another circuit is quickly substituted for the one or portion of one which is in trouble.

It doesn't always work out that way, of course. For there are troubles which must be cleared up before a customer's service can be restored. The every-day sorts of troubles are relatively easy to contend with, however, if everyone has been diligent in his planning and preventive maintenance undertakings. A tree blown down across the line, lightning troubles, a relay that unaccountably sticks, a bullet hole in a cable, and countless other such troubles are all in the day's work.

While the trouble is being repaired, the adverse effect on the customer's operation can frequently be minimized. Perhaps calls can be relayed by telephone company personnel, or certain operations normally controlled remotely can be performed manually. One of the secrets of assisting the customer in handling his operations during periods when we may be unable to furnish him normal service is a good knowledge of how he uses the telephone company fa-

Cable splicers in a manhole cutting-in a new section of cable. Careful work and close coördination are required here not only to avoid interference but to match the circuits with absolute accuracy

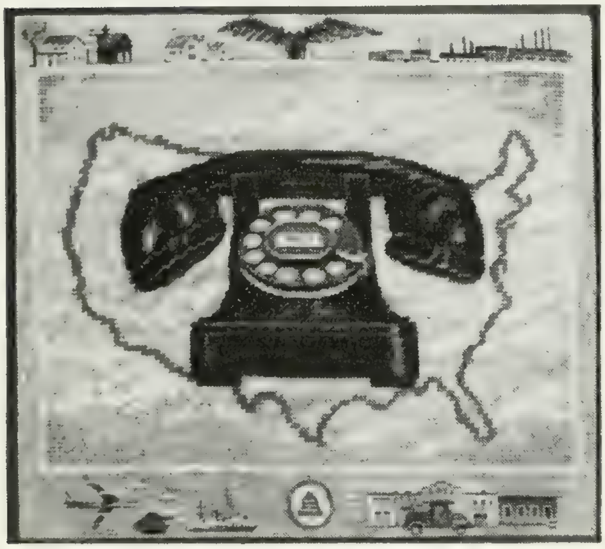
cilities that have been temporarily interrupted.

There are other happenings, however, that are harder to contend with: a widespread ice storm, a hurricane, a severe flood, a landslide that sweeps all in its path with it. Any of these covering wide areas or occurring in critical concentrations of facilities tax the ingenuity of telephone people everywhere and offer a special challenge to the control offices of the dispatch-type services.

A good knowledge of geography and a mental picture of the major Bell System facility routes are valuable at a time like this. All-out emergency measures are in order. Circuitous routes, akin to the detours encountered during major road construction, are the order of the day. Circuits are "borrowed" from their normal day-to-day usage of handling long distance calls and are used to piece together remaining sections of the affected dispatch-type circuits. Wire hastily placed on the ground or hung on any available structure may be used to bridge gaps to restore an interrupted circuit. Emergency radio equipment may be brought into play, or a radio-telephone-equipped car may be used if occasional local or long distance calls will enable the customer to maintain operations.

A Continuing Challenge

THIS COMPOSITE PICTURE may give some understanding of the problems involved in handling this general class of Bell System service. These services in particular must be tailored to fit the specific requirements of the customer, and we must never lose sight of the customer's special problems and requirements. Bell System service means attention to the specialized protection and maintenance requirements of these customers. The special-service field is one that is fast developing with the country's industrial growth and the increase in mechanization. The greater use of the electronic art by the utilities, the railroads, the airlines, and all branches of the Military is giving the telephone companies an ever-increasing opportunity to demonstrate their ability to meet the specialized protection and maintenance requirements of these dispatch-type services. It is a challenge particularly to all Plant people to continue to demonstrate the meaning of Bell System service.



Readers who saw this illustration on the back cover of our last Summer's issue may be interested in the following note, which is from the A. T. & T. *195 Bulletin:*

"A lot of work and planning goes into most advertising, but the recent Bell System ad, 'Woven Into the Fabric of the Nation,' probably set a record for skill and patience when it was decided to use a symbolic needlepoint tapestry for the illustration.

"Mrs. Faith H. Child, Jr., a housewife in Merion, Pennsylvania, was selected to do the needlepoint and was given a drawing to use as the design. With her deadline only six weeks away, and with three children to care for, Mrs. Child worked out a budget for her time to finish the job on schedule.

"The whole thing was worth it, too, for the Bell companies have had many requests for the pattern and even for instruction in the ancient art of needlepoint. The ad has been altogether an effective one, and has done its work exceptionally well."

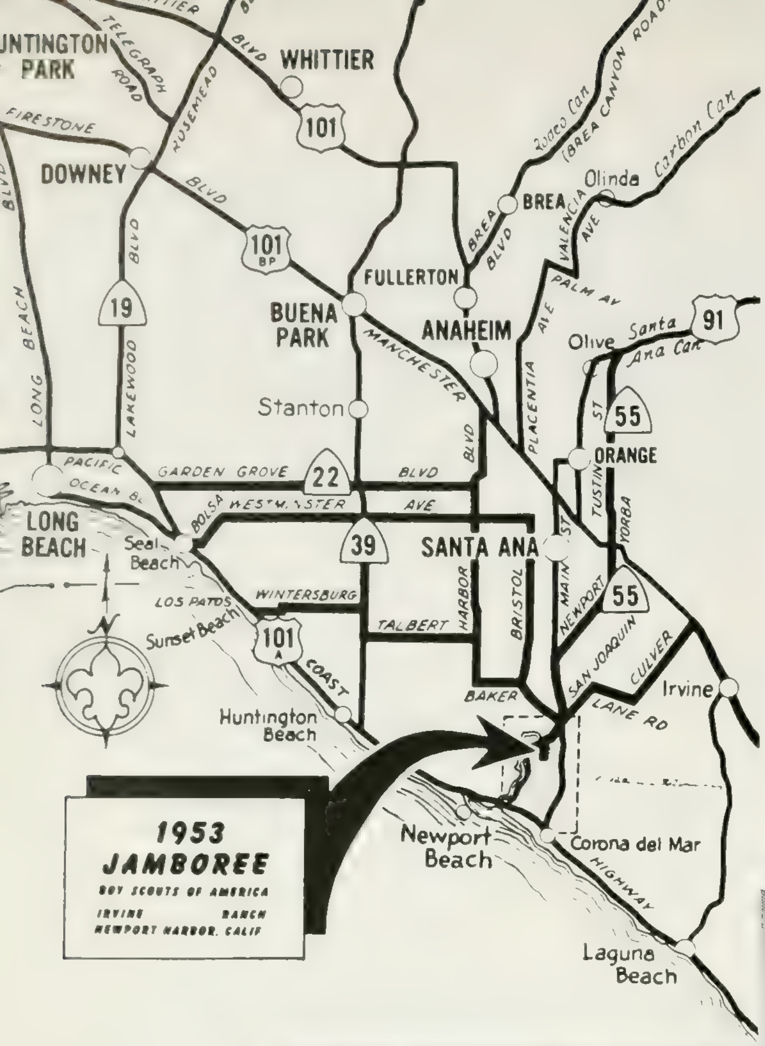
Building to Serve A City for a Little While

PROVIDING *for just 23 days of service* a telephone system which handled an average of more than 10,000 calls a day was the job which the Southern California Area of The Pacific Telephone and Telegraph Company completed in stride for the Third National Jamboree of the Boy Scouts of America, held last July on the historic Irvine Ranch near Newport Beach, Calif. It was the biggest such event ever, with nearly 50,000 Scouts in attendance and with visitors numbering more than 100,000.

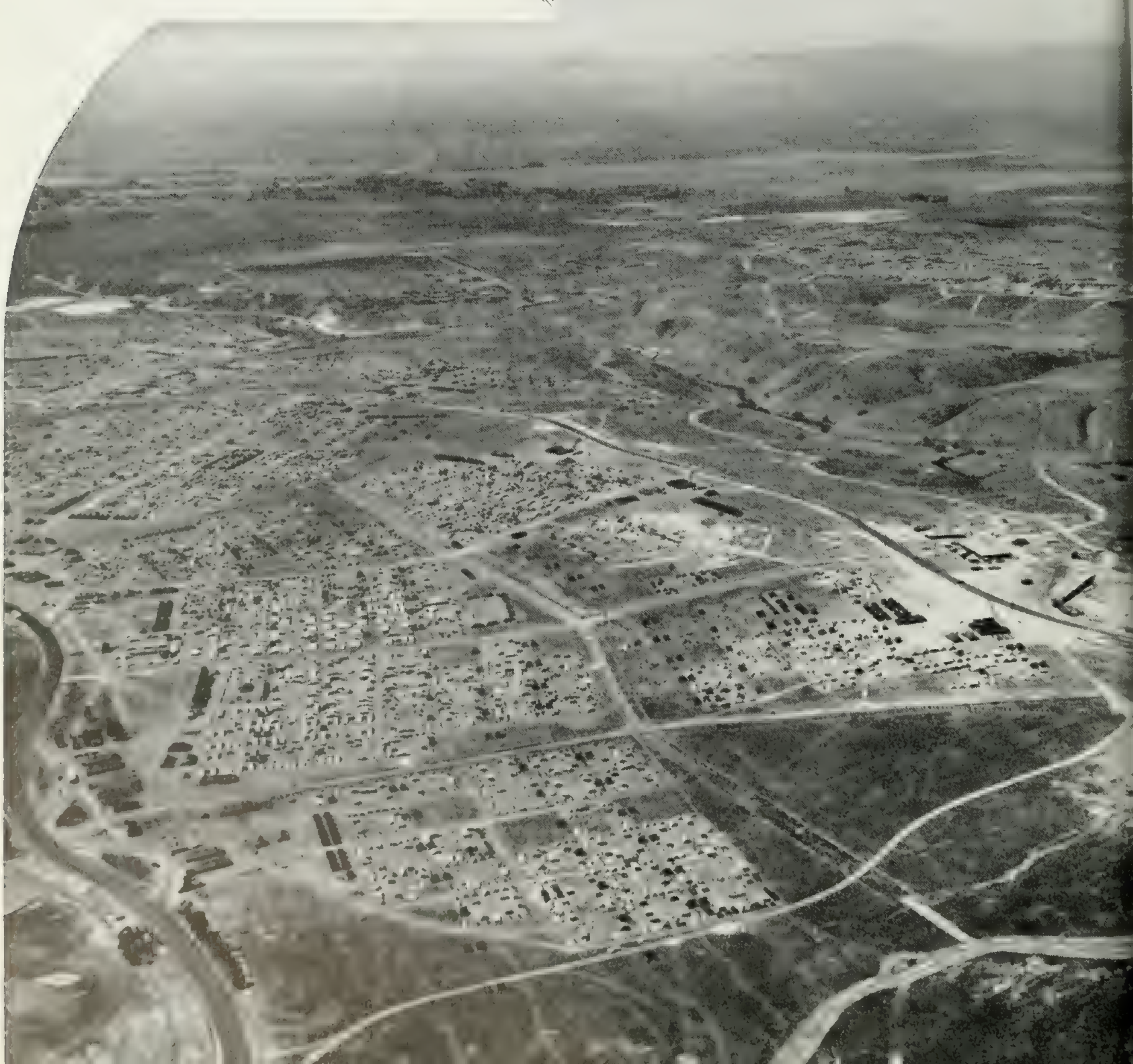
Months of careful planning, engineering, and construction went into the installation of 32,000 feet of cable from the nearest main route to and within the camp, location of 56 public telephone booths and five attended public telephone centers, and connection of a six-position PBX administrative switchboard serving some 250 telephones. An efficient "locator" service kept tabs on Scouts and camp administrators; a telephone call for a Scout was accepted on a "call back" basis and a message was sent to him to return the call through one of the camp's telephone centers.

Nearly 100 telephone operators and supervisory personnel were required to handle calls on the switchboard and to staff the "locator" center. The girls lived in tents at the camp site, and a comfortable "living tent," complete with television, was provided for them.

There have been other Jamborees: one at Valley Forge, Pa., in 1950, and the earliest of all at Washington, D. C., in 1937. In all probability there will be others in the years to come—and Bell System companies will accept similar demands for brief, essential telephone service for Scouts and other groups having special needs, no matter where. The Boy Scout emblem which heads this page bears a motto to which telephone people are no strangers: Be Prepared. The next several pages show how some of those people discharged that obligation in California in July of 1953.



Near Newport Harbor, a few m
from the coast of Southern Califor
stands the Jamboree campsite of 3
acres. It is a part of a 100,000-
ranch which dates back to the la
grant system of the Spanish-Mex
regime and has been in the posses
of one family for more than 80 ye
Miles of water and sewage ma
electric light and power lines, and
ter-camp roads were constructed,
well as the complete telephone sys



Plans for a telephone system to serve the Jamboree were begun almost a year in advance, when C. L. Wall, Pacific Telephone Company commercial service engineer, met with Ray Bryan, B.S.A. director of physical arrangements for the encampment, to discuss communication requirements

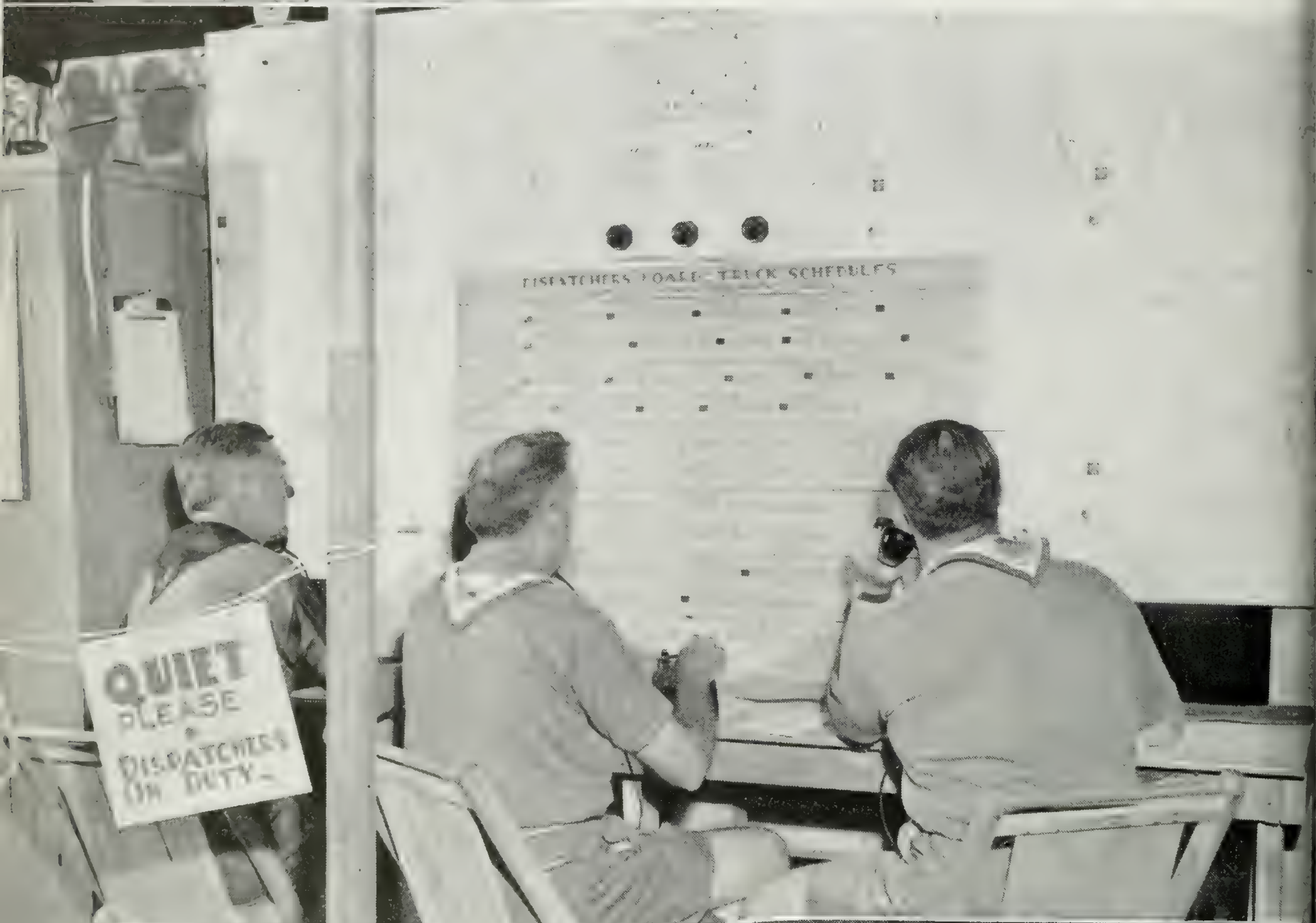
Interdepartmental meetings such as this (above) co-ordinated the responsibilities of all departments. Right: The addition of 18 N-1 carrier systems between Los Angeles-Riverside and Los Angeles-Santa Ana was speeded up and expanded to meet Jamboree needs

Nearly a hundred operators and supervisory personnel were on hand to attend the six-position switchboard (above), the "locator" center in the telephone building (below), and the public telephone centers. Camp life for the girls included doing their own laundry

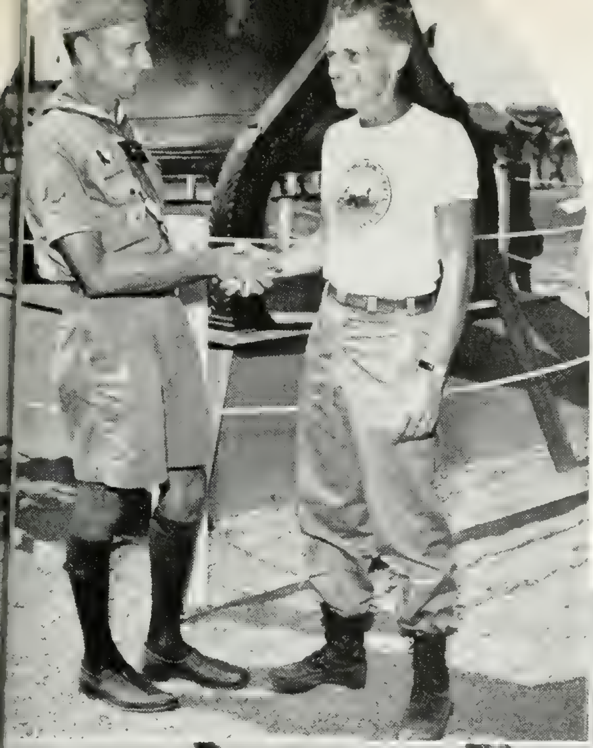
WHEN ATTENDANT NOT ON DUTY USE BOOTHS
1 2
SECTION HEADQUARTERS

Five public telephone tents were spaced throughout the encampment. Traffic and Commercial attendants were on duty till 11 P. M., and Scouts used the facilities to make long distance calls home as well as to locate relatives and friends in Southern California. The messenger at the right is being dispatched to find a Scout who is wanted on the telephone and who will complete the call by calling back from a public telephone tent

These mobile transmitters beamed television signals to 5,000-foot Mt. Wilson, 48 miles away, and thence into regular television channels. Below: Telephones were essential to the administration of the huge enterprise. Commissary headquarters, for example, used three telephones to dispatch its trucks



Right: Scouts waiting in public telephone tents to complete their calls gave the different telephone exhibits keen attention



"Mother Bell" and this Liberty Bell (in replica) joined forces to welcome telephone people whose scout duties brought them to the shores of the Pacific. Left: Scoutmaster H. H. Short, of the Ohio Bell, Dayton, is greeted by Santa Ana District Traffic Superintendent A. W. Gazlay

Above: Newport Beach Manager T. M. Hambrook welcomes Long Liners C. Y. Murphy, Allentown, Pa., J. J. Schmink, Cleveland, O., and P. E. Littlefield, New York, N. Y. Right: Scoutmaster G. R. Leathers, of the Southern Bell, Danville, Ky., is greeted by C. L. Wall, commercial service engineer, Los Angeles, who was responsible for co-ordinating all Jamboree telephone arrangements

Above: These 59 Bell System employees, attending the Jamboree as scout leaders, assembled near the general headquarters of the encampment for this picture. All told, nearly a hundred Bell men participated as scouters. Below: Evening ceremonies such as this brought the scouts together in the natural amphitheatre by massed thousands

Needing to Hire 132,000 Women in 1953, the Bell System Finds that Teamwork among Employees Provides "Leads" Which Are Helpful in Obtaining Qualified Recruits

Recruiting Employees Through Employees

Peter B. Howell and Clifford J. Hedin

RECRUITING THROUGH EMPLOYEES is a form of teamwork as effective and satisfactory as any that exists in the Bell System, where teamwork of many kinds is part of the daily operation of the business. As part of an organized program, telephone people recommend their relatives, friends, and acquaintances for telephone work. Those who qualify are hired. The new employee has a job. The recommending employee has helped his or her friend get a job. The company has a new employee who has a tie to the business—and everyone is happy.

This may well sound like oversimplification. As a matter of fact, it is. Nevertheless, that's the plan in brief. Now let's take a look at the total problem to see just how recruiting through employees fits in.*

This year the Bell System will hire 132,000 women. While this is not the largest number required in any one year, 1953 will go down on the record as one of the biggest employment years. For those who have the recruiting responsibility, moreover, the number is far larger than that. The telephone company does not need simply employees; it needs *good employees*. So that proper selections can be made, it will seek some 700,000 applicants.

New employees are needed for many kinds of telephone jobs. Telephone operators comprise the largest single group of women employees. Including the supervisors in the central offices, the operating force totals 255,000. This is an all-time high, despite dial and other forms of modern mechanization. There is need also for clerks who process customers' telephone bills and for others who prepare the paychecks; for typists and stenographers; and for representatives who handle business-office contacts with the customers. Telephone women hold a wide variety of interesting and important jobs.

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* Both men and women are recruited through this plan. However, as most of the new employees are women, this article deals only with them.

Need for Recruiting

In a very large number of communities, in all sections of the country, the day is gone when applicants for employment arrived at the office of the telephone company spontaneously, without any specific effort on its part to bring them in. Business-wise, the present is an extremely active period. Competition for good employees is keen. If the telephone company is to continue to do a good job in serving the public, it must carry on adequate and sustained programs to attract applicants for employment. Most of the new employees are needed in localities where expansion has been the greatest and the employment situation is the most critical.

During and immediately after World War II, Bell System men and women did an outstanding job in recruiting large numbers of women employees. Many lessons were learned, and they have now been brought back into play.

But conditions in the employment field do not remain static. Other employers are also "working at the trade." The Bell System, then, with a big employment job facing it, has had to develop new ideas and techniques of employment.

The recruiting program in a given community is based on the needs in that community. Some localities are more seriously affected than others. Where an all-out program is required, the telephone company goes at the recruiting job in a variety of ways.

Recruiting Through Schools

Recognizing that each year the high schools of the country graduate thousands of girls who make fine employees, employment representatives of the telephone companies work closely throughout the school year with vocational guidance counselors and other school officials. In frequent visits to the schools, they discuss employment opportunities in the telephone company, and provide carefully prepared and attractively illustrated booklets and reference material. Other activities include the showing of specially prepared movies in the schools, talks to students, and "open house" affairs at the telephone offices for teachers, students, and their friends.

Telephone people, knowing that school officials often want assistance from industry in meeting school needs, always indicate their willingness to coöperate in other ways too. This help may, for example, consist of supplying informative booklets and movies on specialized non-employment subjects for use in science classes. Some schools like to have a qualified speaker talk to seniors on how to apply for jobs and how to conduct themselves during employment interviews. Material on good telephone usage, beneficial to all students and particularly those taking commercial courses, is also supplied.

A Plant recruiter interviews cable men on the job

Telephone companies often help the schools also through "coöperative education." Under this plan, a student goes to school part of the day and works part of the day, and school credit is given for the work experience. Many high-school seniors work as part-time operators—for example, a few hours after school and on week-ends. School needs come first, of course, and each case is cleared with school authorities to make sure there will be no interference with school work. Such girls are frequently employed for other than telephone operating work.

There are real advantages to this plan of part-time employment. The company gets good employees, training peaks at graduation time are minimized, the student is sure of a job after graduation, and—of great importance to her—she has spending money in the meantime. The fact that part-time high school employees are good recruiting missionaries for the telephone company in the schools is important in itself.

Altogether, very happy relationships exist with the schools. It is good for the students, the schools, and the company.

Reaching the Public at Large

Because the average person who is looking for a job turns first to the want ad page of the daily newspaper, classified newspaper advertising is used as an important recruiting tool. Occasional display advertisements support the copy on the classified page. Other media sometimes used to attract the public at large and to back up the other forms of recruiting include radio, television, window displays, car cards, bill inserts, and the like.

Such media, which reach very large numbers of people rather than special groups, bring in a miscellaneous class of applicants, with a consequent lower percentage of those who qualify for employment.

During the last ten years, about a million women became alumnae of the Bell System. Many left to get married, while others resigned because of some domestic situation. Moving to a different town is a common cause of resignation, and if there are no vacancies in the new community at the time, the employee is lost to the telephone business.

Systematic procedures have now been established for communicating with qualified former employees and offering employment to those who wish to resume their work. Many former employees, it is found, are not aware of the company's current employment needs, and welcome an occasional call from "Mother Bell." A serious endeavor is made to arrange for part-time work, in cases where this fits better into home conditions than a full-time job.

Recruiting Through Present Employees

Of all the methods used by the telephone companies to obtain new employees, the best by far is the plan of recruiting through those already on the force.

A headquarters group discusses recruiting of telephone people

A recruiter covering the background of employment needs through a "flip chart" discussion with a group of fellow-employees

Bell System people like their work. So, when the word gets around that the company needs new employees, those who do the hiring find that many applicants are applying because a friend or a relative sent them in.

Unfortunately, the numbers so applying are not nearly enough to meet the needs in most of the places where new employees are required. But it has been discovered that the employment potential among the System's force of about 600,000 employees is great, and that when there are thorough-going efforts to make the most of the total potential, very large numbers of new employees, *good ones,* can be acquired.

The answer, then, is the all-department plan of recruiting through employees. Many of the characteristics of this plan are familiar to telephone people when they find there is an important job to do.

The plan discussed here is a systematic, organized, company-wide approach—as contrasted with the unstimulated and casual plan of recommending relatives, friends, and acquaintances for telephone work, or with spasmodic efforts within a department that has openings. It requires considerable education, careful planning, hard work, and, of course, expense. The results, however, more than justify the time and money spent.

Everyone, regardless of position, participates. There are many examples of ways in which the employees have demonstrated ingenuity and resourcefulness in developing prospects. One engineer telephoned forty-five teen-age pupils in his church school class, to tell them, and some of their parents too, about openings with the telephone company. A Plant man, returning to his home town, spoke to the graduating classes of both the public and parochial high schools about job opportunities with the company. A telephone operator, while helping out with a party for her daughter's high-school friends, "signed up" six well-qualified graduating seniors.

A department head learned in a casual conversation that the daughter of a friend was about to be graduated from college. Normally, perhaps only polite interest would have been shown—but not so this time. He inquired promptly about her plans, explained job opportunities with the telephone company, supplied a card of introduction to the employment office, urged a prompt visit, and the girl is now a service representative, handling contacts with the public.

Successful recruiting brings to everyone a great personal satisfaction in accomplishing something really worth while.

The Minneapolis-St. Paul Program

A GOOD WAY to see how this kind of recruiting program works out in detail is to take the case of the Twin Cities of Minneapolis and St. Paul, in the Minnesota Area of the Northwestern Bell Telephone Company. In these two important communities, 5,500 telephone men and women have been and still are aiding enthusiastically in the solution of one of the most serious problems their company has faced: securing adequate numbers of well-qualified women for telephone jobs in all departments. While helping the company meet its responsibilities, the forces in turn have benefited through the securing of capable employees—"the kind of people they like to work with."

For several years a gradual but steady tightening of the employment situation had been felt. As time went on, it became obvious that all the usual means for obtaining applicants would not be adequate to meet the company's total needs. A plan for recruiting through employees was in effect, but was not nearly as thorough-going as the expected needs for new employees required. When it was decided substantially to expand the program interdepartmentally, a man to head the activity was selected, and a review of programs already in effect in other parts of the Bell System was made by visits to those localities and with people in the A. T. & T. Company's Department of Operation and Engineering.

As a result of all these visits, it became clear in the Twin Cities that:

> (1) *if maximum results were to be achieved, all men and women—management and non-management—in all departments must participate;*
>
> (2) *departmental participation must be motivated by the needs of the company as a whole and not by departmental requirements, since there is a wide difference in need between departments; and*
>
> (3) *a complete understanding of the employment problem among all employees must be established by giving them as much background as possible.*

District traffic superintendent, chief operator, and recruiter review a "visual aid" chart which is an important tool in the recruiting program

Organizing to Produce

ONCE A BASIC PLAN of operation had been developed, and had received executive approval, committees were created to put it into operation. These had, among them, responsibility for over-all policies and procedures, and for telling every employee what it was all about.

The big—the fundamental—step came with the appointment of 35 full-time "recruiters." These people, both men and women, are all from craft groups, and all principal departments have their own recruiters, to work with their own people. The recruiters have, of necessity, enthusiasm, tact, sales ability, and the respect of their fellow workers. The work was new, however, and they needed special briefing on the employment program, the techniques of interviewing, qualifications for starting jobs, and the work of the employment offices. Once those matters were out of the way, the recruiters organized themselves into teams, and are operating in the spirit of friendly competition.

The unique feature of the plan is the function of the recruiter. For they make their contacts not with prospects for employment but with fellow employees. The object is to have present employees refer good prospects to the nearest or most convenient point of hiring, at the same time giving their names to the recruiter to follow up.

This is the crux of the program. This is where the real work is done.

The recruiters began their work with a series of meetings with employees, in groups of six to ten each, to explain the need for large numbers

it takes a lot of people
FOR A GROWING TELEPHONE SERVICE
Opportunity for You
A friendly place to work
THE OHIO BELL TELEPHONE COMPANY
What does a Telephone Job Pay
Have you told your friends?
Girls who like people like telephone work

Posters and leaflets are used throughout the Bell System to remind employees of the opportunities for their friends to become fellow-employees of new employees, and the company's employment policy. Interesting "flip charts" were used to tell the story, and at the close of the meetings an attractive pocket case was given each employee, in which to carry a supply of introduction cards for prospective applicants. Then the plan of interviewing employees individually was started, and since then each employee in the Twin Cities has been interviewed once a month by a recruiter.

A common question for an employee to ask a recruiter at the start of an interview is "What else is the Company doing to attract people?" All of the other measures are then explained, and it is shown how the program of recruiting through employees fits into the recruiting program as a whole.

Recommending Prospective Employees

THE REAL SUBJECT of the interview, however, is *recommending prospects*. Perhaps, if you are an employee of the telephone company, what you are doing right now is thinking of just how many good applicants you could actually send in. The answer, in some cases, may be none. If you have just graduated from high school, you may know several. But many employees are past this stage. Don't think, however, that this discourages a recruiter. Here is where his or her training, ingenuity, and experience come into play.

Your recruiter will probably start by asking you to think first about possible prospects among your relatives, friends, and acquaintances. Then he may ask you if you belong to a bridge club, church group, bowling team, or other social group. Next, he will start you thinking of various other contacts you might have: for example, the beauty parlor, the service station, or the corner store. The big point is to develop an awareness of the possibilities of recruiting. The recruiter won't be surprised if you don't think of a prospect immediately. He will suggest, though, that you start thinking and looking, and he is likely to say he'll be seeing you soon.

These interviews are on company time. They are not merely "contacts," but sessions lasting, upon occasion, up to as long as half an hour. In order to help individual employees participate effectively in the plan, the recruiters naturally do a great deal of listening to questions that are asked. And they do their best to supply answers, so the employee will have a personal desire to supply applicants and an automatic sensitivity to potential prospects.

When an applicant is either hired or rejected, the recruiter is notified, so that he may notify the employee who originated the contact. The fact that new employees are carefully selected is made clear, so that present employees will understand that if their prospect is rejected, it is only after careful consideration.

Helping the Recruiters

THE RECRUITER, being the key person in the program, needs plenty of help and support beyond his initial training. Technical guidance is obtained from a recruiting supervisor. However, since recruiters receive their day-to-day supervision from their own bosses, the bosses have to keep abreast of the program and be actively interested in it. Recognition by management of the efforts of all employees—individuals and groups—is just as necessary in recruiting as in other activities in which the company is engaged.

Recruiters are also helped substantially when they get together with other recruiters to discuss their work, and "experience" meetings are held each week. Since each team has interdepartmental representation, there is a wide difference in the work experience of its membership. It is not an unusual comment that recruiters and the employees both learn a great deal about operations in all departments through this program.

Analyses of results, both from a measurement of actual "hires" and from the standpoint of employee participation, are reviewed in these meetings. Discussions of ways of obtaining greater employee participation have led to continual improvement; in some groups, 100 percent participation has been achieved.

Bulletin board posters, stories in company magazines, and other publicity are helpful to recruiters. To maintain the interest of the employees, recruiters present inexpensive reminders to employees several times a year. These include items such as book matches, hosiery mending kits, plastic card cases, packaged emery boards, pencils, and other gadgets. The cost is low, the good will is high, and a timely recruiting slogan is ever present.

Results

EVERYONE wants to know, of course, how the plan is progressing. To meet this need, a weekly flash report, covering the results obtained by each recruiter and each team, shows the number of employee interviews, applications, and persons engaged. Monthly results are reported by individual recruiters, teams, force groups within the departments, and departments as a whole. An index showing the number of women engaged per 100 employees, for the various groups and for the current and cumulative period, is used. All of the reports are widely circulated, and bulletin board posters are also used to announce the results.

Another significant feature of the plan is the weekly discussion of results and developments in the vice president and general manager's meetings with his department and staff heads. These men are well informed of the progress of the program, and of such opportunities for further improvement as may exist. As a result, recruiting becomes an important subject of discussion at subsequent meetings at all levels in the organization.

In the nearly six months since the all-out program was inaugurated in the Twin Cities, great progress has been made. All force losses have been replaced and growth has been taken care of. What is more, instead of the very substantial shortage of employees which existed at the time, there is now a current "fill" of all positions—and that despite a most critical employment market. Moreover, it has been found that the quality of these recruits is far higher than those brought in before, and that force losses among them are substantially lower.

Recruiting through employees, on an organized basis, has become a "way of life" in many parts of the Bell System. The Minneapolis–St. Paul story is simply a typical one. Programs of this kind will certainly be continued as long as operation of the business requires the addition of sizeable numbers of new employees. If the needs ever subside, employees will continue, but without an organized program, to recommend their friends, as in the past; and in a business as large as the Bell System, many will still be employed.

While the plan has as its main objective obtaining new employees, there are other benefits as well. For when a recruiter talks with a fellow employee about recommending a candidate for employment, the value of a telephone job naturally figures in the discussion. Employees often find that they have a much broader view of the telephone business than they ever had before. And when employees start thinking of the advantages of telephone employment, another look at their own jobs may have an important effect on the reduction of force losses all around.

In successive issues of the British Post Office's *Telecommunications Journal* have appeared installments of "The American Telephone System," an article by William H. J. McIntyre, Telecommunications Attaché to the U. S. Embassy in London. The article's concluding paragraph is the following:

"Let me close on a light note. A little while ago I extracted something from the records of 40 years ago. While searching for it, by accident I came across a mention of Maxwell, the great British scientist, which I feel I should pass along to you. It appears as merely another lawyer's dry question and witness's equally dry answer; and neither lawyer nor witness intended to be amusing. In fact, read on United States soil, I doubt that they would seem even remotely so. But they do read quite differently here on English soil. Just listen to this unwitting gem, mined 40 years ago in the staid atmosphere of a Pennsylvania court room:

"Q. 'Who developed phantom circuits? You said it was known from the time of Maxwell. Was Maxwell a telephone man?'

"A. 'No. Maxwell was kind of the father of all modern electrical science. I do not exactly know how to describe him. He was an Englishman.' "

Telephone Excise Taxes Discussed with House Ways and Means Committee

THE CONCERN with which the Bell System companies regard the present high Federal excise taxes on telephone service was brought to the attention of Congress on August 10, 1953, by Mark R. Sullivan, President of The Pacific Telephone and Telegraph Company.

Appearing before the tax-writing Ways and Means Committee of the House of Representatives, and speaking for the entire Bell System, Mr. Sullivan pointed out that the price which our customers are required to pay for telephone service is considerably increased by the heavy Federal excise taxes which apply. He noted that, while the telephone companies undertake to keep their rates as low as possible consistent with finanical safety, when it becomes necessary to increase the net income of a company, provision must be made for Federal income tax and, on top of that, the excise taxes must be added. As a result, telephone charges must be increased as much as $2.60 in order for a company to retain $1.00 as net income. This is illustrated by the chart shown on the opposite page.

Mr. Sullivan summed up his position as follows:

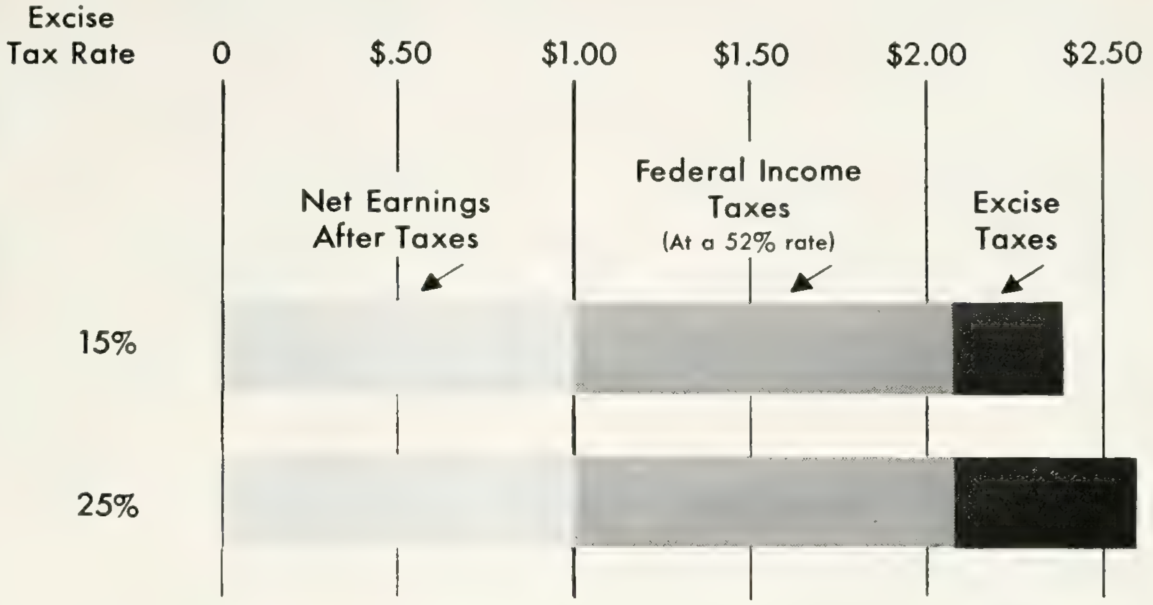
1—Telephone service is a necessity to our modern way of life, yet it bears an unreasonably high and burdensome Federal excise tax.

2—Of the four essential household utility services—water, gas, electricity, and telephone—only telephone service is subject to any Federal excise tax.

3—The objectionable discriminatory aspects of telephone excises are more sharply revealed in light of the fact that they are at a higher rate even than those imposed on most luxuries.

4—The present Federal excise tax rates were enacted under conditions which no longer prevail and under present conditions should not be continued.

5—Any reduction in telephone excise taxes would accrue immediately and directly to the customers—no part of the tax saving could be retained by the telephone companies.



Under present Federal tax rates, the customer must pay up to $2.60 to provide the company with $1.00 of additional net earnings

Telephone rates must be increased a minimum of $2.08 in order for the company to retain $1.00 after Federal income taxes. This increment is inescapable because 52 per cent (or $1.08) of the $2.08 goes to the Federal Government as income taxes. Then the customer must be charged excise taxes on the entire $2.08. Thus, where the 15 per cent excise tax rate applies to the $2.08, the additional excise tax is 31 cents; and where the 25 per cent rate applies, it is 52 cents. The end result is that the customer must pay from $2.39 to $2.60 in order for the company to retain $1.00 as additional earnings.

Strong opposition to the excise taxes on communications was also presented to the Ways and Means Committee by representatives of the United States Independent Telephone Association, the National Association of Railroad and Utilities Commissioners, and the Communications Workers of America—CIO.

The Bell System's Manufacturing Unit Has an Important Share in Helping to Overcome the Effects of Inflation On the Cost of Providing Telephone Service

Western Electric's Part in Offsetting Rising Costs

Howard G. Anderson

WHEN Civil War General Bedford Forrest drawled his oft-quoted dictum about winning battles by "gittin' thar fustest with the mostest," he phrased in homely language the practice that since has been given the imposing title of "logistics." But whether it was colonial housewives sneaking food and bullets to their kinfolk behind stone walls, or our well-meshed land-sea-air supply lines of World War II, the supply function has always assumed A-1 importance in any military campaign.

The "Battle of Rising Costs" which the Bell System has been waging against inflation for the past decade is not unlike a military operation in certain respects. Both require careful advance planning, resourceful leadership, close-knit teamwork, and, last but by no means least, efficient supply—or logistics. And that's where Western Electric comes in. As the System's manufacturing and supply unit, Western undertakes to furnish the Bell companies with the equipment and supplies they want, *where* they want them, *when* they want them. Furthermore, the telephone materials Western makes or buys must be able to give telephone company customers the best possible service at the lowest cost possible.

Western Electric has not been alone in this fight on inflation, of course. Bell Telephone Laboratories, the American Telephone and Telegraph Company, all the operating Bell companies, and Western have tackled the problem as a team, each one helping the other, finding ways to overcome problems jointly that could not be accomplished individually. Their combined objective is to expand the telephone system as rapidly as possible in order to take care of new requests for telephone service; to continue to furnish the best and most dependable telephone service at rates that are as low as possible consistent with financial good health; and to do these things in spite of the inexorable rise in the cost of providing service.

The battle is not over, but gains have been made. Operations have been streamlined, better ways have been found to do the job, costs have been trimmed on every side. Without the efforts made by all the Bell companies in the past few years, the System could not have continued to expand and improve the telephone plant and kept service at its high level despite the adverse effects of inflation on Bell System earnings.

Western Electric Is in the Thick of It

While Western Electric has not been alone, this matter of logistics has put it squarely in the middle of things. Let's take a roving look at a few examples of what has been done on a broad scale throughout Western Electric since 1946 to reduce costs and step up efficiency in the supply end of the telephone business.

Take copper-clad steel wire, for instance. That's the conductor inside the "drop" that runs from your house to the nearest telephone pole. That's the wire that Western produced last year in the amount of one billion two hundred million feet.

Western formerly purchased the conductor wire for this purpose from an outside source. Then the Bell Laboratories-Western Electric team worked out a process for producing a superior wire at a lower cost per foot. Result was wire with the ability to support a heavier load of ice, and not only stronger than the old type but smaller in diameter, and so needing less insulating material.

In this new process, high-tensile-

The 2,200 manila file folders in this pile would be needed to contain the records of the 2,200 cost-reduction cases handled by Western Electric manufacturing engineers since 1946. Each case represents a method of lowering cost and increasing efficiency of Western's tools, methods, and manufacturing processes strength steel wire—tougher than the inner core of the old-type drop wire—enters two huge machines engineered to operate around the clock, each handling 25 wires simultaneously running through the process in one continuous operation. As the wire passes without pause from supply spool to final take-up reel at Western's Point Breeze Works, the machines clean the steel wire and apply by electric current, without interruption, successive coatings of copper, lead, and brass. Controls function automatically to produce wires of uniform conductivity with a minimum use of these metals.

But that's only one chapter in this story of achievement. Old-style drop wire, known as "TP," was in-

Above: Steel wires, 25 at a time, get successive coatings of copper, lead, and brass to prepare them for use as conductors in neoprene drop wire. The wires enter the cleaning and plating tanks at the far end, reverse direction in the foreground, and are finished when they reach the far end again. Right: An operator at Western's Point Breeze Works examines the wires as they move between floors

Conveyors, used to move synthetic rubber from one operation to another, make an unusual pattern in Western's Point Breeze Works

sulated with synthetic rubber, covered with a heavy cotton braid saturated with asphalt compound, and topped off with layers of pitch, mica flakes, and anti-stick solution. Then a far better type, known as "C" was introduced, using synthetic rubber as insulation and neoprene for the jacket.

To produce the huge quantities of drop-wire required, Western Electric engineers designed and set up one of industry's most efficient shops for processing synthetic rubber. Raw materials move by conveyor to big mixers, where they are mixed and timed automatically. The insulating and jacketing compounds move from one step in the process to another by overhead conveyors, and finally are wound in big coils beside the extruding machines, where the coverings are placed on the copper-coated steel wires.

Tests have indicated that "C's" superior resistance to abrasion, sunlight, and general weather conditions adds up to a lifetime of several times that of the "TP" type. Maintenance and repair costs are reduced drastically, telephone users get more dependable service, and the Bell Companies' drop wire costs go down.

"Shooting" wire connections onto terminals eliminates pliers, soldering iron, solder, and many motions in making six hundred million electrical connections a year in Western Electric factories

Relays Get a New Look

ANOTHER OLD STANDBY of telephony, the relay, has undergone changes in the interests of lower production and maintenance costs and improved reliability. A relay is an electromagnetic switching device used in all central offices to connect the calling with the called telephone. Now a new design, named the "wire spring" relay, has made its appearance to challenge the standard type in use for many years.

The new relay is radically different in appearance and manufacturing methods. Gone are the narrow strips of spring metal assembled in layers around an electromagnet which cause the contact points to meet or separate and thus to close or open circuits. In their place are spring wires molded securely into a plastic block. Also eliminated is the arrangement of tiny parts, nuts, and bolts that held the old-type relay together. Instead, a single U-shaped clamp is the principal binding force.

Without altering the fundamental electrical and mechanical principles of operation, the team of Western Electric and Bell Laboratories has created a relay easier to assemble and adjust, a device with greater operating efficiency and longer life, easier to maintain, and requiring less power to operate. And it will be less costly to manufacture.

Such a complex technological device obviously doesn't move directly from the laboratory to the telephone plant. Preproduction models had to be turned out by Western for extensive testing. Alternative designs and methods of manufacture were jointly reviewed by Western and Bell Laboratories engineers. Finally, quantity production processes were developed by Western and the tools, machines, and production lines were designed and built.

At Western's Hawthorne Works in Chicago, home of the new relays, some 67,000 feet of floor space is being readied for the tools and heavy equipment necessary for permanent production facilities for the new product. Within a few months, when permanent production lines are completed, wire will run continuously from supply reels to be straightened, molded in plastic, cut into relay-size lengths called "combs," then have contacts welded in place and be formed and soldered into finished relays—the entire operation practically untouched by human hands. And all this at the rate of one every four seconds—a triumph of manufacturing engineering ingenuity.

"Shooting" Wires On Terminals Saves Money

ANOTHER COST-SAVING DEVELOPMENT, so far-reaching that its effects are being felt throughout the electronics industry, is an amazing new method of making electrical connections without solder. This, too, is a joint achievement of Western and the Laboratories. Solderless connections, now in use in cable terminals and units of central office telephone equipment, are neater, surer, faster to make, and less expensive than the long-familiar type of connection made by hand with pliers, soldering iron, and solder.

Solderless connections are made possible by a pistol-like tool with a power-driven spindle inside the barrel through which the wire is inserted. When the tool is placed over a terminal and the trigger pressed, there's a whir—and a split second later the wire is coiled snugly around the terminal so tightly that the metals of the terminal and wire bite into each other under the pressure. Anticipated trouble-free life of this solderless connection is 40 years. There are no solder splashes, no wire ends to be clipped. And connections can be made to terminals that are so close together soldering would be almost impossible.

Solderless connections sprang from an earlier Western Electric search for a better and less costly way to do a job. Looking for a more efficient way to connect wires to the very closely grouped terminals of the new wire spring relay, the first step was a mechanical wrapping method used in conjunction with solder. Development and improvement of the tool built for that purpose led to the solderless technique.

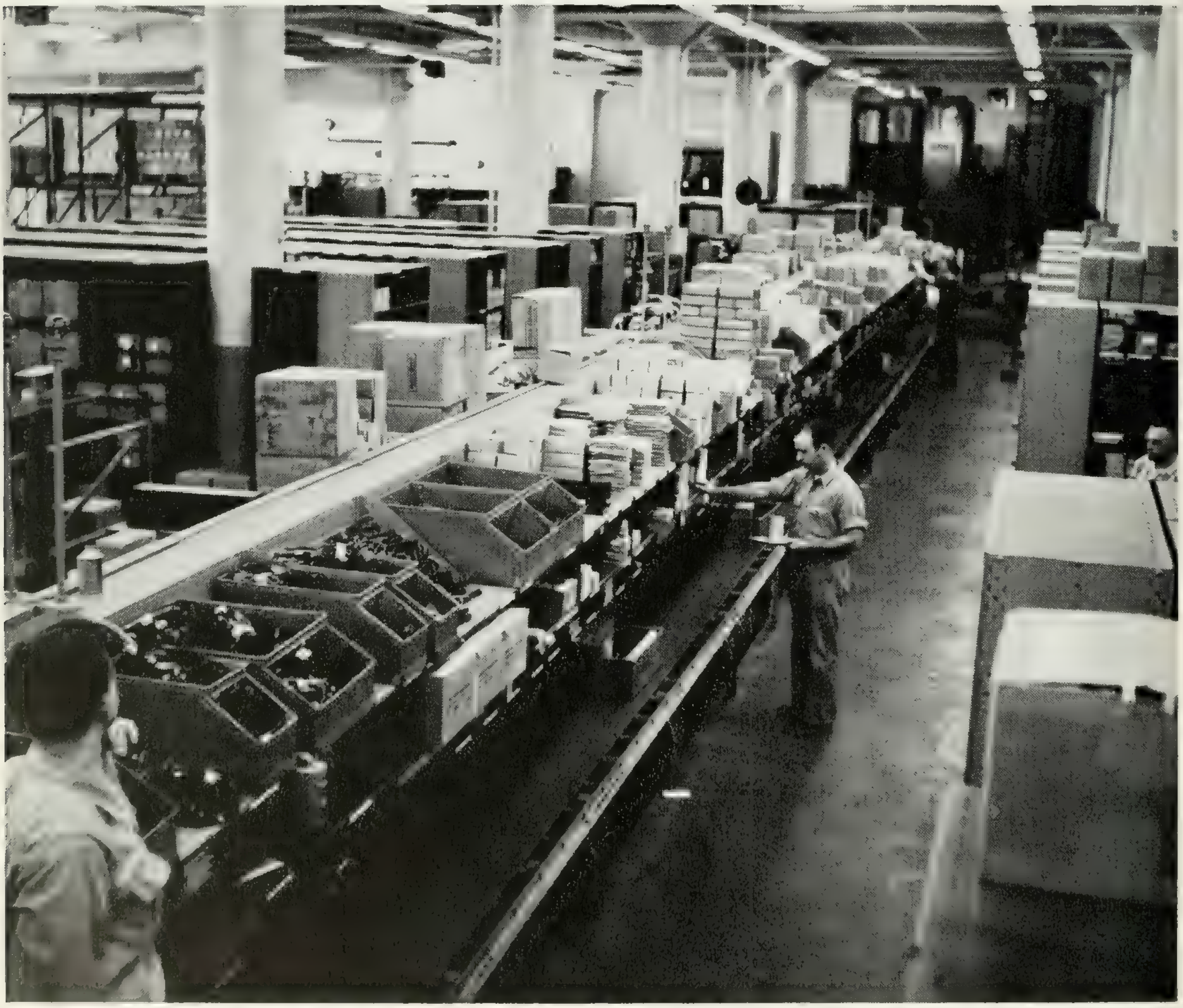
Significance of this radical development and its potentiality as a weapon in the Western Electric cost-reduction arsenal is indicated by the fact that an estimated one billion electrical connections are made annually in the Bell System. Not only do solderless connections save considerable time and money in the wiring of telephone equipment, they also reduce costly inspection operations and cut to a small fraction the time needed to train new operators.

The future of the new technique in Western Electric looms greater each week as work progresses on the conversion of relay and other terminals to the rectangular cross-section found most suitable for solderless connections, and as more and more production work is taken over by the wrapping tool.

Western's Enormous Supply Task

MOVING from manufacturing to the purely supply phase of Western Electric's job—distribution, warehousing, and repairing—the record is equally outstanding. Western's distributing houses from coast to coast have seized every opportunity to streamline operations, cut costs, increase efficiency, and provide better service to their telephone-company customers.

An important step in the streamlining of distribution work has been the construction of ten new distributing warehouses during the last decade, replacing inadequate leased quarters. (Several more new houses are now in the planning stages). Into them Western has put all the experience of a lifetime spent in learning how to repair, store, select, pack, and ship telephone materials with speed, maximum efficiency, and lowest cost per item handled. And while new buildings have been growing, a revolution has taken place inside the structures, a quiet revolution in the handling of telephone supplies called "palletization."

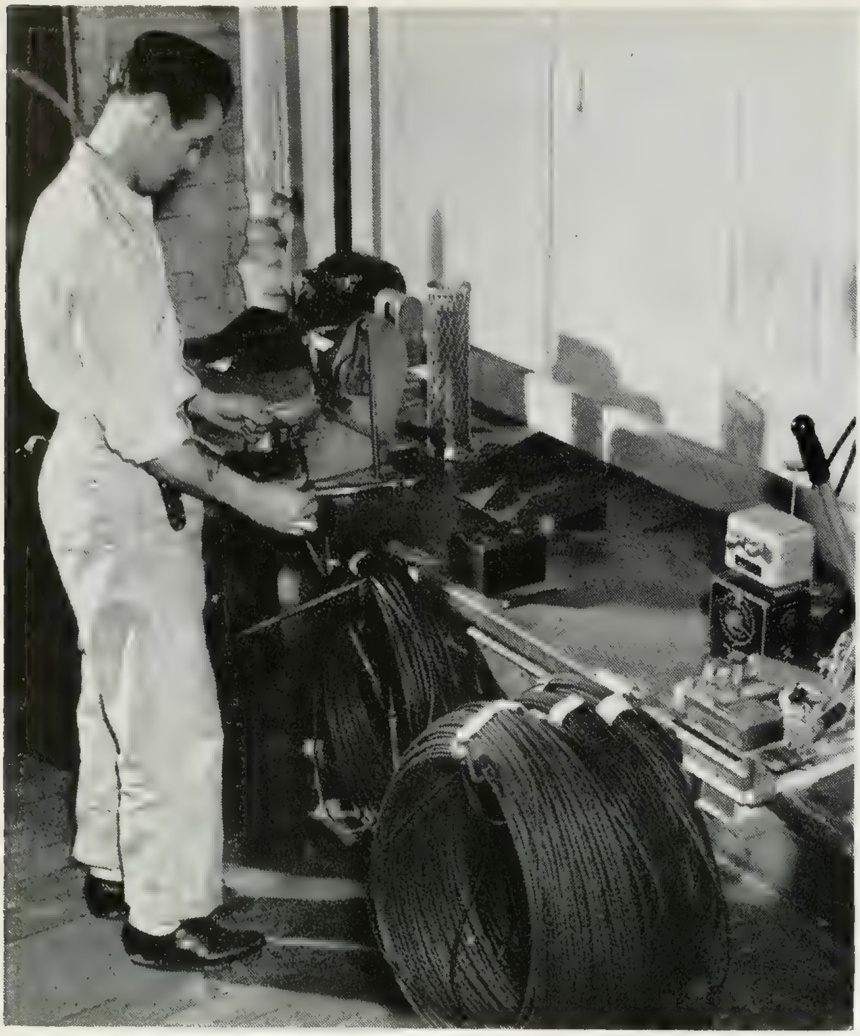


Items frequently called for on telephone company orders are located along conveyor lines in Western Electric distributing houses. Boxes, each representing an order, ride the conveyors and are filled by stock selectors as they move along. This scene is in the new home of the Seattle Distributing House

Reels of telephone cables three tiers high show space conservation in Western's distributing houses. A new cable-measuring machine pulls cable from overhead reels and cuts it to exact length

Palletization—the machine age extended to material handling—means the handling and storage of supplies on wooden pallets, or small mobile platforms designed to be raised, lowered, and moved about on power trucks equipped with strong metal forks. Materials are practically never touched by human hand or shifted by human muscle until taken off the shelves to fill a telephone company order. Before this innovation, containers were stacked by hand and could not be piled higher than seven feet, the limit of a man's reach. Acres of space above the stacks were wasted. Now, however, metal racks designed to accommodate exactly a loaded pallet reach to the ceiling, sometimes as high as 20 feet. A truck picks up a heavy pallet, carries it to its proper aisle, lifts it with ease to the highest rack, and deposits it neatly into its own tailored compartment. If the pallet were stacked with eggs—which are *not* a stock item in Western's Houses—chances are not a shell would be cracked, so gently does the operation handle telephone apparatus.

A late refinement of this technique utilizes a slender new truck nicknamed the "straddle stacker." It can jockey a load into lifting position in an aisle only seven feet wide, compared with the 10 feet required for maneuvering



Short pieces of drop wire, which formerly could only be junked, are now spliced together at Western's distributing houses and restored to use

other fork trucks. This gives a dividend of three feet of storage space in each aisle.

Another time- and money-saver used wherever possible in distributing houses is the conveyor line. One such line wends its way through the warehouse to pick up the smaller items called for in telephone company orders. Men known as selectors are stationed along its path to add items to the boxes gliding past. Lately a new wrinkle has been added in the larger houses—an express line conveyor moving directly to the packing area at twice the speed of the "local" conveyor. Orders which need to move along just a short section of the slower line are pushed off onto the speedier one when filled. The minutes saved by this device, multiplied by thousands of orders, mean speedier and lower-cost service.

To the telephone companies, the scope of Western's distributing operations is as convenient as a housewife would find living next door to a modern metropolitan department store. Even with the telephone companies ordering, as they do, as many as 1,600,000 items per month from stock (and an item is one entry on an order, whether the quantity wanted is one or a thousand), about 97 percent of the items are shipped on the exact date specified on the orders, and three-quarters of the items are shipped the same day the orders are received. As a result, the telephone companies can keep their investment in field stocks at a bare minimum, confident they can get from Western what they need within a matter of hours.

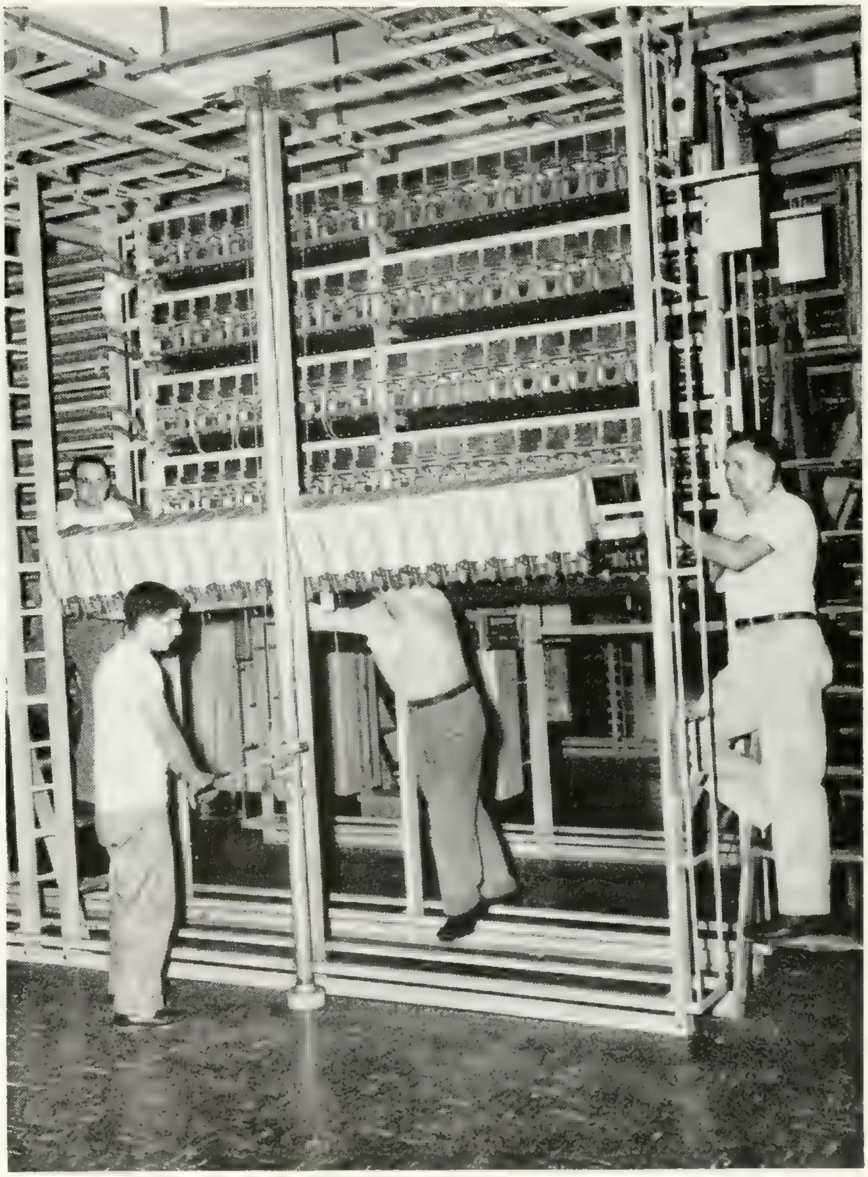
Repair of telephone equipment and supplies is another aspect of the "make-every-penny-count" policy in the distributing houses. Each year, telephone sets by the millions and switchboard positions by the thousands are completely overhauled and sent back into service. The job isn't confined to telephone equipment, by any means. Last year, among other things, Western Electric houses repaired and refurbished 17,000 pairs of pliers, 33,000 extension ladders, and 18,000 operator's chairs, and sent them back to telephone companies in good-as-new condition.

Last year, also, more than 38 million feet of drop wire was reclaimed and given a new lease on life. Telephone company installers saved wire taken out of service as well as the unusable short lengths left over at the ends of coils, then sent them to Western distributing houses to be inspected, spliced together, and vulcanized. With 38,000 coils of drop wire returned to service by this method, the Bell Companies chalked up a net saving of nearly $10 on each coil.

Responsibility for Installation

THE JOB of installing most of the central-office equipment and larger PBXs used by the Bell System—the erecting, assembling, wiring, and testing of the units shipped from Western's plants—falls to the Installation organization. Here, too, emphasis is on economy as well as quality and service. Western's installation organization has a formalized cost reduction program of its own similar to that in the factories. During 1951 and 1952, improvements in installation methods and tools resulting from this program brought savings amounting to hundreds of thousands of dollars.

Among the many special tools standardized for installation use were hydraulic trucks, power-driven reciprocating saws, portable test oscillators and a new winch-type hoist for



The new hoist being operated by the man on the floor lifts shelves of step-by-step switches, and can be set up by one man in a few minutes—as compared with an outmoded type which took two men nearly an hour to erect raising units of step-by-step central office equipment in position.

Long shelves of step-by-step switches are far too heavy to be lifted by hand, and a mechanical device is required to do the work. The hoist used for many years was moved from job to job in four packing cases, plus two 12-foot lengths of metal. The device weighed 600 pounds and it took two men nearly an hour to set it up.

Not long ago, installation engineers came up with a new hoist that's so simple the proverbial child can operate it. It weighs about one-fifth as much, packs entirely in a single case, can be set up by one man without tools in a few minutes, and costs considerably less than the hoist it replaces.

In these days of high construction costs, space in new central office buildings is at a premium, and aisles have been narrowed to conserve construction dollars. But narrow aisles raise a knotty problem in maneuvering bulky cable reels and other equipment during installation. So, to make this economy practicable, Western's installation people worked out a method by which central office cables can be put in final position and all wires formed and cut to proper length before most of the equipment frames are installed. Numerous special fixtures, actually light-weight dummy frames, were designed to make it easy to tailor each wire to the proper length. Now, installers "running" the cables have plenty of space in which to work and the job is done faster and more economically. Equally important, since most of the equipment is not installed at the time the cabling and wiring is being done, the lint and dust resulting from these operations cannot get into the equipment to cause trouble later on.

Purchasing nearly every type of product needed by the Bell companies from outside sources of supply is another operation where gains have been made to help fight inflation.

Western Electric's purchasing job is a big one. In 1952, Western's purchases ran the alphabetic gamut from "abrasives" to "zinc," and included some 1,300 other products in between. Over 100,000 different items were bought in varying quantities from 27,500 suppliers across the nation, at a cost of $600,000,000.

Reducing Directory Costs

Western's purchasing people have not been content with the normal economies of their operation, such as quantity ordering and the elimination of duplicate purchasing staffs. They have been wide awake to new ways of extending the efficiency of their operations.

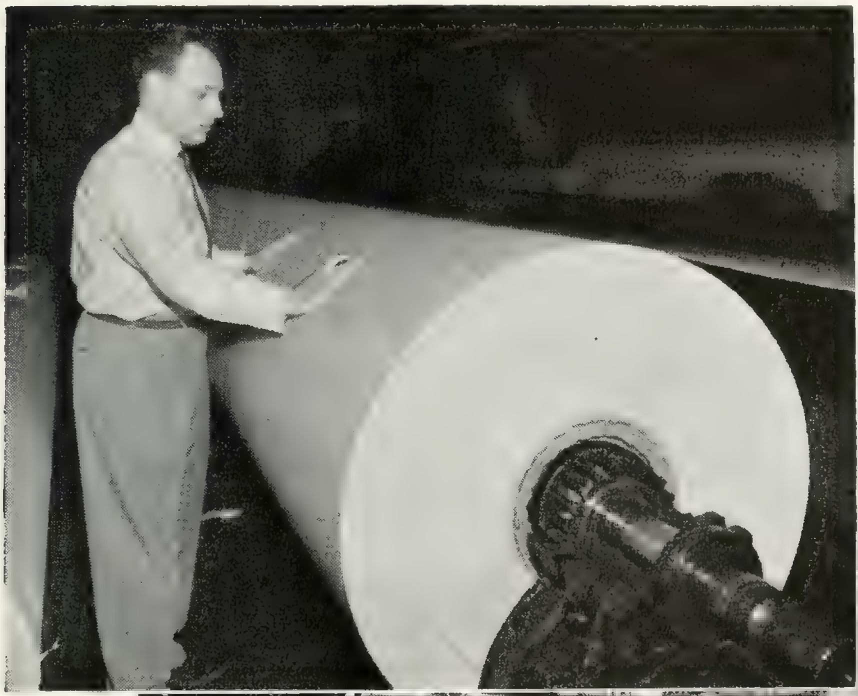
A striking example lies in Western's program for cutting the cost of printing telephone directories. About five years ago, a new type of super-high-speed press well fitted for directory work became available. These presses offered the lowest-cost method of printing directories for large cities, but their high original cost put them out of reach of a number of printers familiar with exacting directory work.

Western Electric purchasing people made it possible for these printers to buy the new equipment by writing long-term contracts. This enabled the printers to spread their investments over periods as long as ten years.

With the new presses installed and operating in ten different printing plants, directory costs took a nose dive. Printing speeds were nearly tripled and the time required to turn out a directory job was reduced appreciably. Savings will run into several millions of dollars over the life of the contracts.

The largest of the new presses can print as many as 1,500,000 directory pages per press per hour. That's a total of 416 printed pages—equal to a directory three-quarters of an inch thick—shooting from a single press *every second.* The paper, in ribbons over five feet wide, travels through the press at a speed of almost 1,000 feet a minute. When a roll of paper is used up, a new 1,800 pound roll is fastened to the end of the depleted roll by a device called a "flying paster" without even slowing down the speed of the press.

Teamwork of the Purchasing organization with the Bell Laboratories is illustrated by the case of a particular dry battery formerly purchased



Left: A Western Electric inspector checks a roll of directory paper 17½ feet wide. Below: This superspeed press prints the equivalent of a ¾-inch-thick telephone directory every second

At Western's subsidiary, Nassau Smelting & Refining Co., copper, lead, zinc, tin, and other non-ferrous metals are salvaged from outworn telephone equipment, and most of it is returned to Western Electric for re-use by Western as a commercial brand product. About 400 test sets, each using 15 of these batteries, were in service, and their batteries required replacement about six times a year. When the number of test sets in use began to mushroom, Western's purchasing people and the Laboratories went into a huddle, and a special battery for the test sets was specified by the Laboratories engineers. These proved not only better for the particular use but could be obtained at a saving of 47 cents for each battery purchased.

Economy extends even to the "scrap heap," for Western Electric plays the role of salvager for the System on a sizable scale. Nothing that has commercial value is discarded. Such items as old burlap bags, empty bottles and cans and miscellaneous scrap iron and steel are sold locally at the best possible figure. One Western Electric Works location melts much of its own brass and copper scrap. But the bulk of the System's scrap—mainly unrepairable telephone equipment, wire, and cable—is sent to Western Electric's own smelter, the Nassau Smelting and Refining Company, on Staten Island, New York.

Practically all of the metal content of the 58,000 tons of scrap received last year at Nassau was salvaged. Most of the non-ferrous metal in this imposing quantity of junk was returned to Western as copper and lead alloy materials to be refashioned into new products for telephone service. At the present time, about one-seventh of the copper bars used by Western for making wire come from Nassau's furnaces, while nearly one-fifth of the System's lead requirements are met from the same source.

Economies Alone Are Not Enough

THE PRECEDING EXAMPLES, gleaned from the records of Western's manufacturing, distributing, installation, and purchasing organizations, represent just a few of Western Electric's efforts in the continuing struggle to furnish the American people the kind of telephone service they have learned to expect at a price that is fair to them and to the telephone company. But even the contributions of all members of the Bell System's three-way team—new and better designs from Bell Laboratories, more efficient operation by the Bell telephone companies, and lower production and distribution costs by Western Electric—can't cancel inflation's gains unaided.

As A. T. & T. President Cleo F. Craig told share owners last April:

"People get to thinking that if telephone rates are not adequate advancing technology will somehow remedy the situation. Under today's conditions this is totally unrealistic. Over the years, our technical advances have made it possible step by step to build more efficient facilities. But in the inflation through which we have been passing—the effects of which are very much with us—these improvements can but partially offset the tremendous increase in the cost of telephone service."

Forbes: Telephone Pioneer

By Arthur S. Pier. Dodd, Mead and Co., New York, 1953

A book review by Ralph E. Mooney

William Hathaway Forbes headed one or another parent company of the Bell System from the beginning of the year 1879 until the Summer of 1887, when he wrote to a friend: "I am about retiring from the presidency of the American Bell Telephone Company, as I have given as many years to it as I am willing to."

During his presidency, he dealt with a number of monumental tasks. The first was fighting for and securing a settlement with the Western Union Telegraph Company, which at that time was attempting to compete for telephone business with the owners of the Bell patents. This was followed, year by year, by an increasing tide of litigation over attempts to break the patents in various ways. These culminated, in 1885, with an attempt by the Federal government to have the patents voided. Out of all this litigation, five suits finally reached the Supreme Court of the United States, and the Bell patents were upheld in every instance.

And all this while, there were problems incident to the development of telephone service. Growth figures for those early years read surprisingly small today, but that did not make the work any easier for the relatively few people involved. Nearly every problem that we have with us now was present then—at least in embryo. Where we can point to one that's wholly ours—such as the need to extend customer toll dialing, for instance—Forbes and his associates had one that has almost been forgotten, such as the need to develop workable underground cable.

Because of all this, Arthur Stanwood Pier's new biography, "Forbes: Telephone Pioneer," is a first-class contribution to the literature of telephone history. The lengthy and complete quotations from Forbes's letters to Alexander Graham Bell, Gardiner Green Hubbard, and others give new illumination to a period and to characters that should not be forgotten. The origin or strengthening of many a Bell System policy is indicated.

Forbes entered the War between the States as a second lieutenant in the First Massachusetts Cavalry, and rose to the rank of lieutenant colonel. He was captured by General John S. Mosby's forces, and out of this accident of war arose a cordial relationship between them which continued until Mosby's death. Forbes was exchanged in 1865, was in action at Lynchburg, and was among the officers present at Appomattox when Generals Ulysses S. Grant and Robert E. Lee discussed the terms of surrender of the Army of Virginia. These and other incidents have an important place in the first part of the book.

After his return from the army, Forbes married Edith Emerson, daughter of Ralph Waldo Emerson, famous New England author and philosopher. Some of Forbes's letters yield interesting material on Emerson family affairs.

Throughout much of the biography are paragraphs revealing Forbes's skill in and deep enjoyment of yachting. Among his other interests, aside from business, were travel, shooting, horses and horsemanship, and the administration of his residential estates.

William Hathaway Forbes was born in 1840 and died in 1897. His second son, W. Cameron Forbes, became a director of the American Telephone and Telegraph Company in 1919, and, save for the two years from 1930 to 1932 when he served as American Ambassador to Japan, he has continued in that office to the present time.

William Hathaway Forbes
1840–1897

Who's Who & What's What

(*Continued from page 127*)

tric. He went to work as assistant editor of the Allentown plant's employee newspaper. After nearly two years on that job, he transferred to the Western Electric public relations group at 195 Broadway, New York.

A BOOK REVIEW dealing, telephone-wise, with the period from 1879 to 1887 comes appropriately from the pen of RALPH E. MOONEY, who since 1945 has been historical librarian of the A. T. & T. Company. His telephone career began in 1924, after some years of newspaper and trade journal experience, when he joined the Public Relations Department of the Southwestern Bell Telephone Company in St. Louis. Before transferring to New York in 1944 he had been editor of the *Southwestern Telephone News*, and in recent years he has been a frequent contributor to this MAGAZINE. His most recently published article was "The First Seventy-Five Years," in the issue for Spring 1951.

Bell's Brantford Home Becomes a Canadian Historic Site

HERE, AT THE HOME OF HIS FATHER, ON 26TH JULY, 1874, ALEXANDER GRAHAM BELL DISCLOSED FOR THE FIRST TIME HIS CONCEPTION OF THE PRINCIPLE OF THE TELEPHONE. FROM BRANTFORD CALLS WERE MADE TO MOUNT PLEASANT ON 3RD, TO HIS HOMESTEAD ON 4TH, AND TO PARIS, ONTARIO, ON 10TH AUGUST, 1876. THE LATTER IS NOW RECOGNIZED AS THE WORLD'S FIRST LONG DISTANCE CALL.

THIS INSCRIPTION on a bronze tablet set into a stone monument was unveiled by two of Alexander Graham Bell's granddaughters on September 12, 1953, when the Bell homestead at Brantford, Ontario, was designated as a National Historic Site by the Government of Canada. The granddaughters, Mrs. Lilian Grosvenor Coville, of Washington, D. C., and Mrs. Nancy Fairchild Bates, of Ann Arbor, Michigan, represented their mothers, Mrs. Gilbert Grosvenor and Mrs. David Fairchild, at the ceremony.

In her dedication talk, Mrs. Coville said: "Alexander Graham Bell was born a Scotsman, became an American citizen and remained one to the end of his days, but he always loved Canada. He kept a home in Canada for more than 30 years and it was by his own request that he now rests on an open hillside atop Beinn Breagh, his 'Beautiful Mountain,' at Baddeck, Nova Scotia."

The principal speaker at the dedication, T. Roy Woodhouse, president of the Ontario Historical Society, described various early experiments which Dr. Bell carried on at Brantford.

Interesting sidelights of Dr. Bell's life were disclosed by Mrs. Coville, who arrived for the ceremony in a plane piloted by her son, Gilbert Grosvenor Coville.

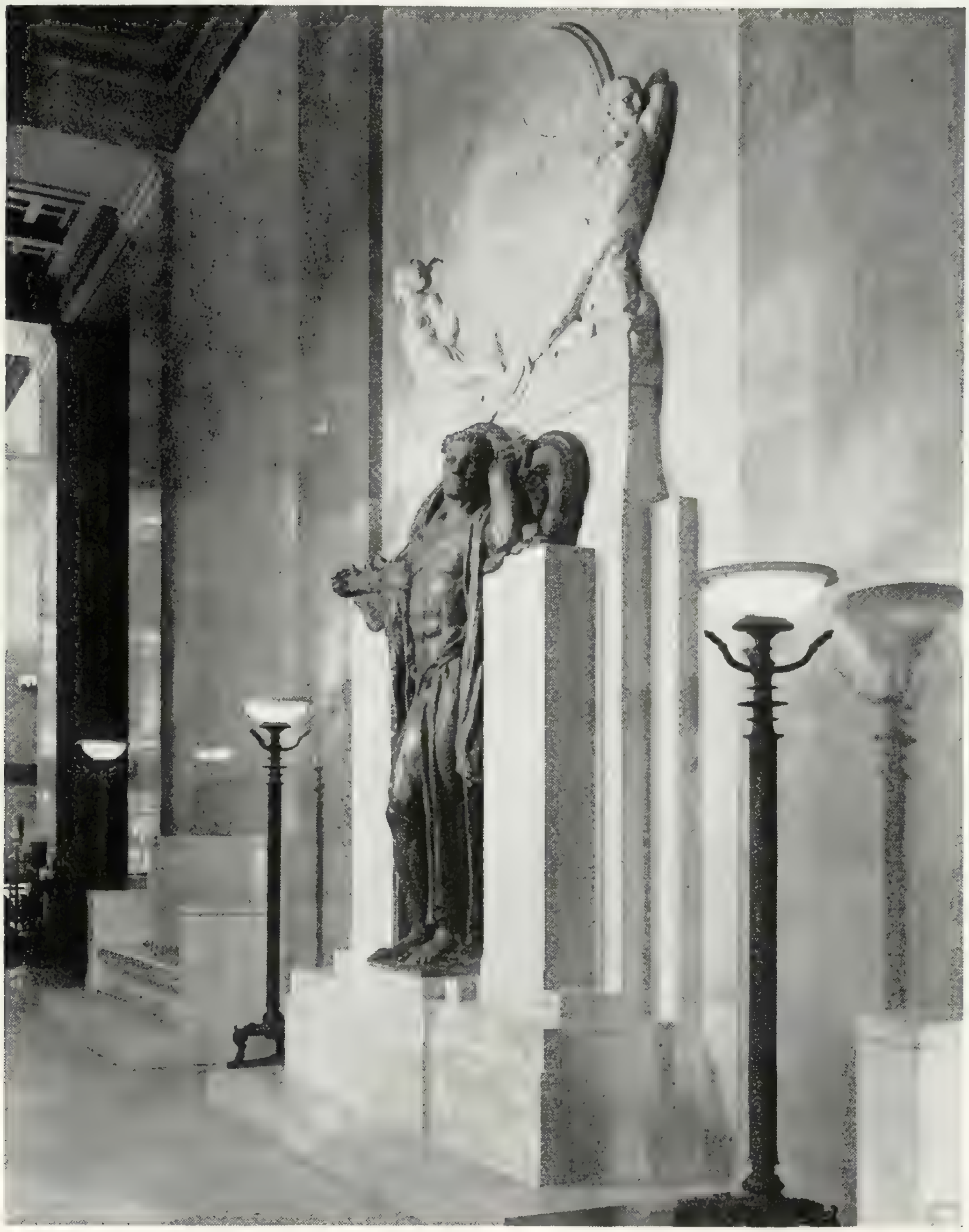
"It seems appropriate," she said, "that my son and I should fly from Nova Scotia, the home of grandfather's mature years, to Brantford, the home of his young manhood. In his youth, as you know, the possibility of flying in heavier-than-air craft was considered a fool's dream. In his mature years he staked his scientific reputation on his firm, continuing belief that man would soon fly. When we were small children, grandfather used to tell us that some day we would fly the ocean, dine in London and breakfast next morning in New York. He said that our sons would take to the air, yearning over airplanes as we did over sailboats. Although light plane flying is not yet as popular as he expected, several of his great-grandsons have owned their own planes."

Mrs. Coville also explained the importance of sound in her grandfather's life. "No man was ever more conscious of sound than Graham Bell," she said. "He worked best at night, late at night, when all the world was still. Noises of any kind disturbed his train of thought—even clocks. At one period," she recalled, "the clock repairman came often. Then it was discovered that Grandfather had been going around in the wee small hours stopping clocks because their noise bothered him."

The committee in charge of arrangements for the celebration in Brantford was made up of members of the Charles Fleetwood Sise Chapter, Telephone Pioneers, members of the Parks Board, and representatives of various local organizations. Representatives of the Bell System, in addition to Canadian Government officials and local residents, took part in the dedication ceremonies.

Twenty-five Years Ago in the Bell Telephone Quarterly:

From Volume VII Number 4, October, 1928



Service to the Nation in Peace and War

An allegorical group of sculpture in bronze and marble has been put up in the main lobby of the Telephone and Telegraph Building, 195 Broadway, New York City, in a place which was designed for its reception when the building was erected. This group, which is the work of Chester Beach, the noted sculptor, expresses the idea of the words inscribed on the base: "Service to the Nation in Peace and War." The heroic central figure in bronze represents Service, calling and sending forth the power of the nation. Conceived as a great dynamic force, Service stands before the flag, conscious of the vital epic romance, past and future, that is carried through the air. Behind the head of this figure are lines of uncoiling wire, and at the base, partly covered by the flag, a wreathed helmet of the World War bespeaks the thought of those who gave all in the service of their country. Above the bronze, in marble blending with the walls, are figures representing the messages of peace and war as they speed along the wires. They encircle a sculptured outline of the United States, on which East, West, North, and South are interlinked with lines of communication.

The Next Seventy-Five Years

Back in 1878—that's 75 years ago—the first commercial telephone switchboard was placed in service in New Haven, Connecticut. It was a most important development in the growth of telephone service.

You see, before the switchboard was invented, a telephone instrument was connected only to the other instruments on the same line. Of course, you couldn't reach the telephones not on your line. It really isn't any wonder that some folks regarded the telephone as a toy, limited in usefulness.

But the switchboard changed all that. It made it possible for any telephone to be connected to any other telephone in town. And, as soon as people saw how convenient and useful telephones could be, the business really began to grow! Within a few months telephone companies, with switchboards, started up in towns and cities across the land.

This year is the seventy-fifth Anniversary, the Diamond Jubilee, of telephone service in many communities. The year 1878, when the telephone itself was two years old, saw the first telephone exchanges in Connecticut, California, New York, Delaware, Massachusetts, Missouri, Oregon, Illinois, Michigan, New Hampshire, Iowa, Ohio, Wisconsin, Pennsylvania, the District of Columbia and the Dominion of Canada.

Telephone companies in many of these places are holding formal celebrations in 1953. Many more will celebrate their Seventy-fifth Anniversaries in 1954.

And, after seventy-five years of service to the community, Bell telephone companies are still seeking ways to make telephone service better and to keep its cost within the reach of everyone. They will do their best to make the next seventy-five years even greater than the last in the advancement of communications.

Telephone story heard on the *Telephone Hour* radio program

PRINTED IN U. S. A.

Bell Telephone MAGAZINE

FEB 20 1954

Fifty Millionth Telephone Installed in White House
Cleo F. Craig

Bell System Helps Turks to Modernize Telephones
Donald S. Bridgman

Helping Turkish Telephone Men to Greater Skills
Bruce E. Osgood

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John M. Shaw

Towers and Beams: A PICTURE STORY

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Functions of the Safety Engineer in Industry
William V. Kahler

rican Telephone & Telegraph Company · New York

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A Medium of Suggestion & A Record of Progress

JUDSON S. BRADLEY, *Editor.* *Published four times a year for the supervisory forces of the Bell System by the Public Relations Department of the*
AMERICAN TELEPHONE AND TELEGRAPH CO., *195 Broadway, New York 7, N. Y.*
CLEO F. CRAIG, *President;* S. WHITNEY LANDON, *Sec.;* JOHN J. SCANLON, *Treas.*

Who's Who & What's What in This Issue

A YEAR AND A HALF AGO, in discussing the A. T. & T. executive group in the issue for Summer 1952, this MAGAZINE said of PRESIDENT CLEO F. CRAIG: "Since July of 1951, Mr. Craig has been President of the American Telephone and Telegraph Company. His Bell System career, beginning in 1913, illustrates how broad may be a man's experience within the corporate confines of one or two companies. For his assignments in the Long Lines Department took him from St. Louis to Kansas City and Atlanta en route to New York, and to such diverse posts as district plant chief, plant accountant, and construction supervisor, among others—with a six-year interval as a special representative in the A. T. & T. General Department—before he became General Manager of Long Lines in 1933. He was elected Vice President in charge of the Long Lines Department in 1940, and the following year moved to A. T. & T. headquarters. There his vice-presidential responsibilities included, in turn, charge of the Departments concerned with Personnel Relations, Operation and Engineering, and Finance and Revenue Requirements." At the beginning of 1954, that still seems appropriate as a brief statement.

THE BELL SYSTEM career of DONALD S. BRIDGMAN was recounted in these pages for Summer 1953, to which he contributed "Bell System Employment for College Graduates." His present article is based not only on correspondence with Mr. E. D. Wise in Turkey but on his two-way experience in recent years in helping to make our government's program of technical assistance for foreign countries effective. For his Personnel Relations responsibilities have included helping to arrange for the reception of foreign visitors by Bell System companies and for interested and qualified telephone people to undertake periods of foreign service.

The mutually broadening experience of the Turkish engineers and the Michigan Bell Telephone Company, as related by

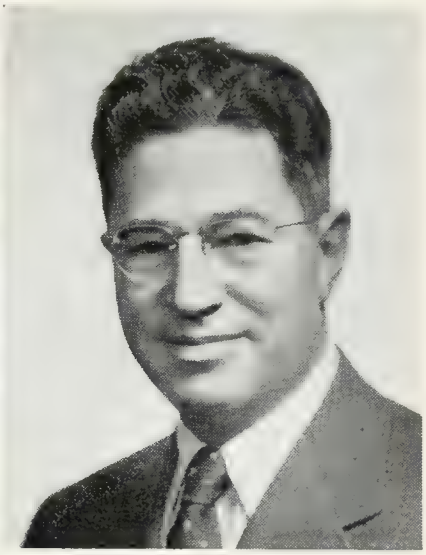
Cleo F. Craig

Donald S. Bridgman

Bruce E. Osgood

John M. Shaw

Harold R. Huntley



William V. Kahler

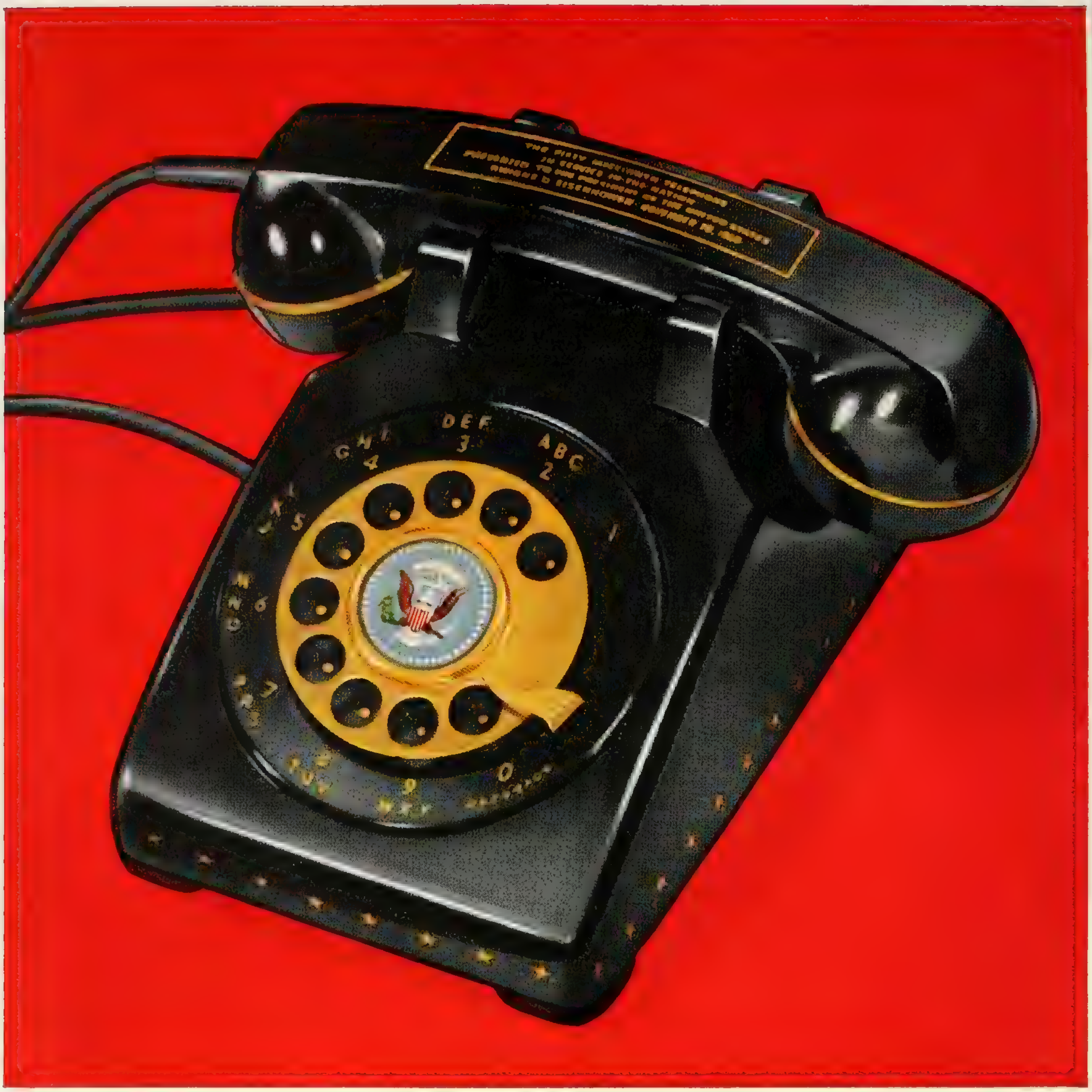
Bruce E. Osgood, shows the opposite face of the coin. From 1927, when Mr. Osgood joined the Commercial Department of the company, to 1950, he served in various sales and supervisory capacities—and for two years during World War II was with the Bell System Communications Committee in Washington. In the latter year he transferred to the Personnel Relations Department as supervisor of general personnel activities. As may be deduced from his tale, he was in general charge of arrangements for the visiting engineers.

Varied responsibilities and a varied career have fitted John M. Shaw for such a special assignment as the one represented in this issue. Born in Scotland, he came to this country as a boy, and was employed both in retail business and in several public utilities before joining the then Information Department of A. T. & T. in 1930. He subsequently served the Chesapeake and Potomac Telephone Company as information manager and the New York Telephone Company as an assistant vice president in the Public Relations Department before he returned to the A. T. & T.'s Public Relations organization in 1944. Here, as assistant vice president, he has charge of the company's radio, motion picture, open house, and public lecture and exhibit activities. His most recent previous contribution to this Magazine was "The Blackboard Comes to Life," in the Spring 1945 issue.

As an articulate transmission engineer with a twinkle in his eye, Harold R. Huntley belies his own remarks about the inability of the clan to communicate with others. Joining the Wisconsin Telephone Company in 1917, as transmission and protection man, he took a year out to complete work for his B.S. degree, returned to the company in 1921, and subsequently became transmission and protection engineer and, in 1928, transmission engineer. In 1930 he moved to New York and A. T. & T., where he was an O. & E. group head in the plant engineering division, and later in charge of groups handling electrical coordination and toll transmission. For three years he has held the position of transmission engineer. He is a Fellow of the A.I.E.E. and a Senior Member of the I.R.E.

The meeting of the American Society of Safety Engineers which President William V. Kahler of the Illinois Bell Telephone Company addressed in Chicago last Fall was held in conjunction with the meeting of the National Safety Council.

(*Continued on page 248*)



THE FIFTY MILLIONTH TELEPHONE
IN SERVICE IN THE NATION
PRESENTED TO THE PRESIDENT OF THE UNITED STATES
DWIGHT D. EISENHOWER
NOVEMBER 18, 1953

Mr. Craig Discusses Significance of Historic Event as Bell System and Independent Telephone Industry Join to Present Symbolic Instrument to President Eisenhower

Fifty Millionth Telephone Installed in White House

Cleo F. Craig

Editor's note: *The fifty millionth telephone placed in service in this country was presented to Dwight D. Eisenhower, President of the United States, on Wednesday morning, November 18, in the White House. Presentation was by Cleo F. Craig, President of American Telephone and Telegraph Company, representing the Bell System companies, and Warren B. Clay, President of the United States Independent Telephone Association, representing nearly 5300 independently-owned telephone companies. A commemorative scroll which they also presented to Mr. Eisenhower is reproduced on the next page. They were accompanied to the White House by Rosel H. Hyde, Chairman of the Federal Communications Commission, and C. L. Doherty, President of the National Association of Railroad and Utilities Commissioners. A dinner held that evening in a Washington hotel to signalize the event, and attended by representatives of the government, the armed forces, and the telephone industry, was addressed by Mr. Craig, Mr. Clay, and Postmaster General Arthur E. Summerfield. Mr. Craig's remarks follow:*

THERE ARE a lot of reasons why we telephone people are happy to be here tonight.

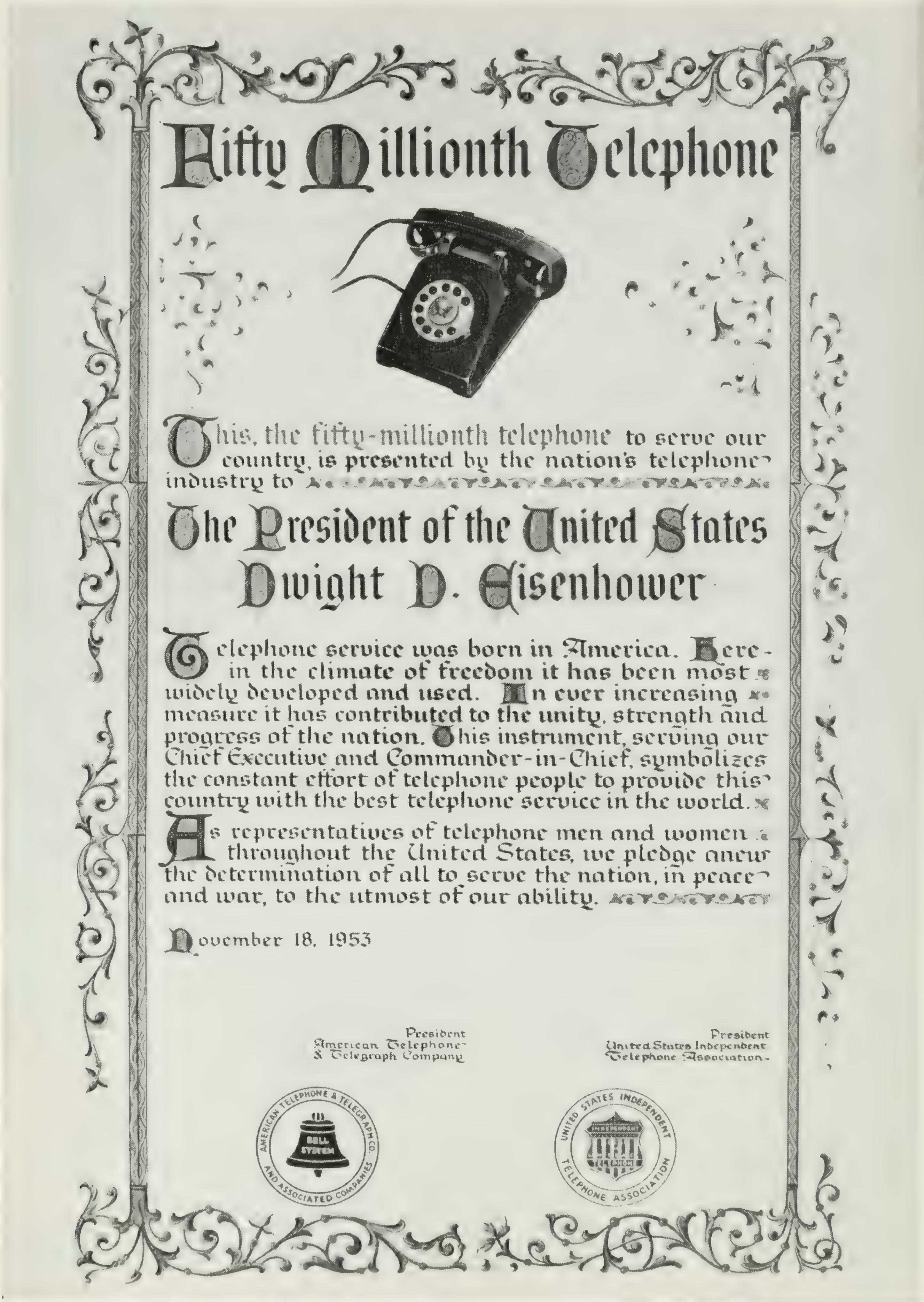
But speaking for us in the Bell System, I'd like to say first to our associates and friends of the Independent telephone companies that one of the things we like the very best is this chance to be together with you.

We are pleased no end—as co-authors, so to speak, of the telephone story—to take part with you in marking our joint achievement.

We are also delighted to join with you in extending the warmest possible welcome to our guests from government and the armed services and all who share our deep interest in telephone progress.

My thoughts on this occasion are quite simple.

President Eisenhower's acceptance this morning of the fifty millionth telephone was a gracious and inspiring recognition of the part we play in the life of the nation. The President has done us great honor. He has also given us, I think, new cause



Fifty Millionth Telephone

This, the fifty-millionth telephone to serve our country, is presented by the nation's telephone industry to

The President of the United States
Dwight D. Eisenhower

Telephone service was born in America. Here in the climate of freedom it has been most widely developed and used. In ever increasing measure it has contributed to the unity, strength and progress of the nation. This instrument, serving our Chief Executive and Commander-in-Chief, symbolizes the constant effort of telephone people to provide this country with the best telephone service in the world.

As representatives of telephone men and women throughout the United States, we pledge anew the determination of all to serve the nation, in peace and war, to the utmost of our ability.

November 18, 1953

President
American Telephone
& Telegraph Company

President
United States Independent
Telephone Association

This handsomely engrossed scroll, signed by Messrs. Craig and Clay, accompanied the telephone they presented to President Eisenhower on November 18, 1953 to weigh our opportunities and our responsibilities.

Let me recall to your minds something the President said on another occasion. I think the connection will be clear.

In his Inaugural Address last January, he observed that the strength of all free peoples lies in their unity. And he went on to say, "To produce this unity, to meet the challenge of our time, destiny has laid on our country the responsibility of the free world's leadership."

Those words give expression to a compelling fact. We in this country are face to face with the plain truth that the responsibility of leadership is ours. We could not escape it even if we wanted to.

Mr. Craig points out to Mr. Eisenhower a feature of the presentation telephone

What does this mean to us who provide America's telephone service?

To my notion, it means that a very considerable share of the responsibility the President speaks of rests on us. The nation's capacity for leadership in the free world begins with unity at home. If Americans are to come together and work together with greatest effectiveness, they must be just as free as possible to talk with each other. They must learn from each other, think with each other, plan with each other, grow with each other. They must communicate. And they must be able to do so with complete ease and freedom, wherever they are and whatever their need.

Of course I am not saying that the telephone by itself can create unity. But it certainly can and must nourish and feed it and aid and abet it. It can and must help it to flourish and grow. In this day and age, the telephone is indispensable to the unity and progress of our country, and no one knows what great things may have their beginnings in the way we do our job.

Another thought:

This country leads the world in telephone service because we have never let up in our efforts to find a better way. We wouldn't be serving fifty million telephones today if we were still limited to the methods and means of the past. The quality of service wouldn't attract that many customers, the cost would be too high, and even if these things were not true we couldn't find enough people to do the job.

Furthermore—and this is what I want to emphasize—the very progress we are celebrating, and the changes we set in motion, affect us fully as much as they affect anyone else.

FOR INSTANCE, we make it possible for industry and the armed forces to coördinate their operations on a broader and broader scale—and then what happens? They promptly ask us for services that require us to coordinate our own work more than ever before.

Again, telephone progress has greatly expanded the local service areas where subscribers have a close community of interest. And again the result, in more and more places, is to bring Independent and Bell companies into the closest possible association in providing the local service.

In such ways, and notably also in the spread of long distance dialing, the advances we are making directly influence ourselves. Nor is this to be wondered at. We can hardly expect to bring the nation closer and closer together without the same thing happening in our own back yard. The happy fact is that there is now more down-to-earth, day-to-day working together throughout the entire telephone industry than there ever was before. Nothing but good can come of this, and in any event there is just no other way to get on with the job.

All I want to say on this point can be summed up in a few words. First, we of the Bell System are tremendously glad that you people of the Independent telephone companies are just the people you are. We're glad it's you we are working with. Second, let's keep it in mind that the continuing progress of the business always creates a lot more good than it creates problems. If that were not so, none of us would be here tonight.

In conclusion, I hope profoundly that none of us will ever forget the true nature of the service we render.

It is human—living—personal—friendly.

It is something we do for the family next door and for the business down the street.

THE REAL MEANING of fifty million telephones is not in their total number but in the people we bring together in every community in the land. The secret of our success in serving others is not in the machines we use but in the ways we choose to use them. We have always used machines. As we use them more and more in the years ahead, we must be diligent to make sure that our human spirit of service is fully maintained and always shines forth strong and clear.

You will remember another thought that President Eisenhower expressed in the speech I have already quoted. He said, "Whatever America hopes to bring to pass in the world must first come to pass in the heart of America."

I submit also that whatever we of the telephone industry hope to bring to pass in our country must first come to pass in the hearts of telephone people.

We can only make a nation of neighbors by being good neighbors ourselves—good neighbors to everyone we serve, in every community and corner of the land. That is the way, and the only way, for us to keep on increasing our contribution to the unity of our country, the strength of the free peoples, and the hope of peace in the world.

Fifty Million Telephones

AMERICA is the birthplace of the telephone. In 1878, only two years after making his invention, the youthful Alexander Graham Bell wrote: "I believe in the future, wires will unite different cities, and a man in one part of the country may communicate by word of mouth with another in a distant place."

But even Mr. Bell's broad vision did not fully encompass how widely his invention would be developed and used. By the turn of the century there were one million telephones in the United States, by 1929 there were 20 million, by 1946 there were 30 million. Expansion during the post-war years has been greater than during any other time. In the years 1946–53, 20 million telephones were added to the system.

With more telephones than the rest of the world combined, Americans now make, on an average day, more than 178 million local calls and six and a half million toll and long-distance calls. Conquering the barriers of time and distance, the telephone has made a neighborhood of the nation, linking cities, towns, farms, offices and homes across the length and breadth of the land. It has quickened the pace of our accomplishments, and has contributed in increasing measure to the nation's strength, security, and progress.

The product of many, many minds, the telephone system exists through the joint endeavors of 21 Bell System telephone companies and nearly 5,300 independently-owned telephone companies. More than two million Americans either share ownership in the business or are engaged in telephone work.

Serving the nation's Chief Executive and Commander-in-Chief, the fifty millionth telephone symbolizes the constant effort of the industry to provide the United States with the best telephone service in the world.

For Nearly Three Years, Former Telephone Executives Have Implemented the Objectives of the Goverment's Foreign Operations Administration on the Bosphorus

Bell System Helps Turks to Modernize Telephones

Donald S. Bridgman

On April 23, 1951, a team of five recently retired Bell System men and two others on leave of absence from Bell operating companies, all with long administrative or engineering experience, left New York for Turkey by air. Their purpose was to assist the Turkish Ministry of Communications in the rehabilitation and development of that country's telephone system. Today, nearly three years later, seven former Bell System men are still carrying on this work in Turkey. All are retired, and two were in the original group.

This unique contribution of Bell telephone men to this country's technical assistance program abroad was initiated in the fall of 1950, when the Turkish Economic Mission here asked the American Telephone and Telegraph Company for assistance in the proposed program. As the result of subsequent discussions with the chairman of that mission and representatives of our government's Economic Coöperation Administration (now the Foreign Operations Administration), A. T. & T. agreed to undertake to find highly qualified Bell System men who would volunteer for the work in Turkey.

In addition, the Michigan Bell Telephone Company later undertook to carry out the second part of the program through providing, on a cost basis, an appropriate training program for ten Turkish engineers in various aspects of telephone work here.

The entire project has been conducted as part of our government's technical assistance to friendly nations under the Marshall Plan and Mutual Security Program, now administered by the Foreign Operations Administration.

"A Fine Example of Coöperation"

The Turkish telecommunications project is a fine example of how the United States shares its technical know-how with other nations of the free world. The work accomplished is also a fine example of coöperation between government and private industry. Acting as a team, government and industry have contributed materially, not only to the economic strength, but also to the security, of Turkey. Because the security of the United States is inseparable from that of other free nations, this effort has added to the strength and security of our own nation and our own people.

Harold E. Stassen
Director, Foreign Operations Administration

Pressing Need for Rehabilitation of the Telephone Service

The great importance of this project was immediately recognized. At that time, the population of Turkey was about twenty million. Its territory contains great natural resources, and is in an extremely strategic location. Turkey, moreover, is the only nation throughout history in which a democratic form of government has been established through peaceful election immediately following a military dictatorship. Its people are strongly anti-communist and their fighting qualities were again demonstrated by the magnificent performance of their troops in Korea.

In recent years, Turkey has made notable economic progress, and can look forward to still further development. Its telephone system, however, was wholly inadequate. Originally built and operated by the British, it had been taken over by the Turkish government 15 years earlier. There were only about 60,000 telephones, or approximately one-third of a telephone per 100 population statistically speaking—as compared to 28 per 100 population in the United States. Two-thirds of these telephones, moreover, were in Istanbul and Ankara, and many villages and towns were wholly without telephone service.

The toll network covered the country reasonably well, but most pole lines carried only a single pair of wires. The only possible connection with the outside world was through a 3-channel carrier circuit to Sofia, Bulgaria; but because of political and maintenance difficulties this link was of little value. In Ankara alone there were eight different types of telephone equipment in use, and four types of carrier equipment were employed on the single toll route between Ankara and Istanbul.

The service was extremely expensive: a new installation cost about a hundred dollars, including advance payment for a few months, and toll rates were about sixteen times those in the United States. Despite this

A portrait of the late Kemal Ataturk, father of modern Turkey, hangs behind the former Director General of Posts, Telephone, and Telegraph Administration in Ankara as he and Mr. E. D. Wise met to discuss affairs through the young woman interpreter

fact, there was a large unfilled demand for service, particularly in the major cities of Istanbul and Ankara. Both from the point of view of economic development of the country and from that of potential military requirements, strengthening and expansion of the telephone system seemed essential.

The first major step in the selection of the initial team to go to Turkey was taken when Earl D. Wise, who had just retired as vice president and general manager of the Pacific Telephone and Telegraph Company's Washington-Idaho Area with over 40 years' service, volunteered to act as its coördinator and was accepted in this capacity by the Turkish Mission and E.C.A. Early in 1951, Mr. Wise flew to Turkey to obtain first-hand knowledge of the problems to be encountered and the types of men most urgently needed. On his return, he interviewed telephone men in all parts of the country who were interested in the project and were suggested by their companies.

Before taking off, late in April, the men selected spent a week in Washington securing invaluable information about the technical assistance program and about Turkey. The group, with their assignments in Turkey, were as follows:

E. D. Wise, vice president, Pacific company: coördination and general relations with the Turkish Posts, Telephone, & Telegraph Administration.

E. C. Balch, chief engineer, Michigan Bell Telephone Company: general and equipment engineering.

J. E. Mannocci, assistant vice president, Pacific company: traffic operations.

A. F. Wilson, assistant vice president, Ohio Bell Telephone Company: commercial operations.

V. E. Tyson, supervisor of supplies and motor vehicles, New England Telephone and Telegraph Company: equipment maintenance, apparatus repair and distribution.

L. J. Simonich, plant extension engineering, Illinois Bell Telephone Company: outside plant engineering.

W. E. Badden, division construction superintendent, Michigan company: outside plant construction and maintenance.

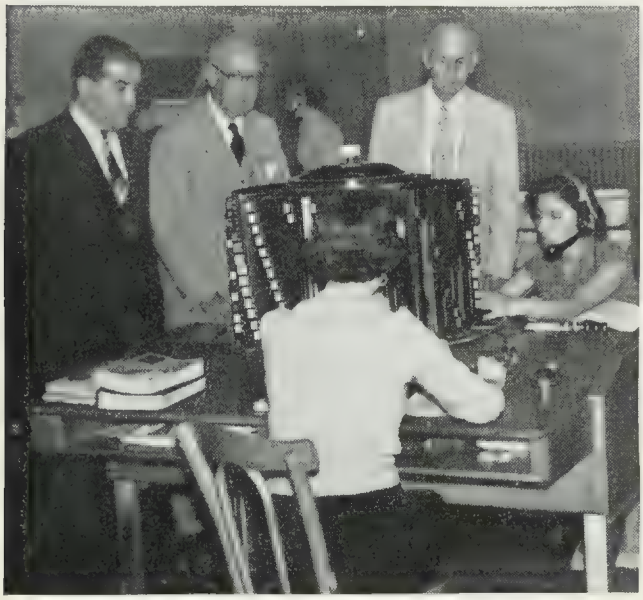
Because of the nature of their assignments, the last two men listed were active employees on leave. Of the others, two retired in order to participate in this project.

Most of the men in this first group remained a year or eighteen months; but Mr. Wise and Mr. Mannocci have stayed on continuously, and A. D. Lewis, retired division commercial superintendent of the Indiana company, arrived in the fall of 1951 to take up the commercial operations work. A year later, however, only these three men remained in Turkey, primarily because of a curtailed Turkish budget for the project. Its importance was recognized once again, however, for the budget year

Miss Vera K. Hearn, American secretary to the staff, discusses telephone directives with Mrs. Guzin Baytin and Mrs. Honul Manioglu, translators and interpreters beginning last March, and Mr. Wise returned to this country two months earlier to secure qualified men for additional assignments.

Recruits and Replacements

THIS NEW GROUP took off with him on March 19 and 20, and included the following men for the assignments shown. One had already retired; the others applied for retirement in order to undertake this work.



Messrs. J. E. Mannocci and A. D. Lewis accompany Mr. Necdet Teney as he inspects an information desk in Ankara. Below: These overseas radiotelephone positions now afford connection between Turkey and many parts of the world

Glen Gardiner, outside plant engineer, Northern California area, Pacific company: outside plant engineering.
R. W. Deardorff, transmission and protection engineer, Oregon area, Pacific company: transmission engineering.
T. M. Libby, transmission engineering, Washington-Idaho area, Pacific company: carrier and radio engineering.
H. A. South, division construction superintendent, Southwestern Bell Telephone Company: outside plant construction.

In the opinion of the Bell System men, there have been three other real members of this team.

One, who joined the first group soon after its arrival and remained until her return to the United States in the summer of 1953, was Miss Vera K. Hearn, its American secretary, provided by the F.O.A. Miss Hearn's father owned and operated the telephone company in Grove Hill, Alabama, for many years, where she gained knowledge used not only in her regular duties but in helping to train the operators for the Ankara-New York radio telephone circuit opened early in 1953. As a result, the operators have developed not only efficiency but a slight southern accent in passing their calls.

Two Turkish young women, Mrs. Guzin Baytin and Mrs. Gonul Manioglu, acting as interpreters and translators, have been most pleasant to work with, and through their knowledge of Turkish customs have kept the group out of trouble many times. On rare occasions when misunderstanding developed between Turkish officials and members of the advisory group, it is suspected that the interpreting was more diplomatic than literal.

There have been, of course, a number of obstacles to overcome in developing effective cooperation between the consulting group and the Turkish telephone management and in quickly bringing about major improvements in the telephone system. One of these, obviously, is the difference in language—which makes it difficult for the consultants to get their ideas across and for the Turks to secure full understanding of their problems. The Turks, too, are a sensitive people, justifiably proud of their history and achievements. Such a people cannot be expected to accept advice given in a critical spirit.

Cables provide new voice paths beneath the historic Bosphorus. Below: The Turkish P. T. T. now handles the laying of its submarine cables

Such difficulties have been resolved, in large measure, by mutual respect, patience, and close "on the job" association, which have brought about an excellent relationship that is now working very well. One striking illustration of this real achievement occurred at a dinner given some months ago for the new Turkish Minister of Communications and attended by a number of the ranking officials of the telephone division and the American consultants. This Minister is responsible for the railroads, seaways, and airways, as well as the postal, telephone, and telegraph systems. At the dinner, the new Minister welcomed the attendance of the foreign-

Mr. H. A. South, expert in outside plant construction, assisted an American agricultural mission by devising this efficient apparatus for stacking hay. And when (right) a crucial rope broke, he volunteered to go aloft and execute repairs

ers who were assisting in the development of the telephone system. The Director General of the Posts, Telephone, and Telegraph Administration, in responding, paid Mr. Wise particularly the high compliment of calling him not a foreigner but at least half Turk.

Administrative Problems

Another serious obstacle to progress, recognized by the Turkish P.T.T. administration as well as the consultants, has been the fact that the communications system has been operated as a government bureau, with its revenue going directly into general government funds and its expenditures coming directly from them. In addition, a 1943 law spelled out the number of employees in the P.T.T. by occupation and location and their rates of pay. These rates, moreover, were below those paid not only in business but in other government operations.

However, a new law, which had been pending about two years, was passed in July, 1953, and went into effect in October. It establishes the P.T.T. system as a government-owned industrial enterprise, under a Board of Directors, with much greater financial and operating independence. It is now probable that a functional organization will be set up and that, after the readjustment period, far greater progress can be made.

Nevertheless, there have been solid accomplishments in the Turkish telephone system during the past two or three years. On Jan. 1, 1951, the number of telephones in service was 65,000; two years later this number was 97,000—a gain of about 50 percent; and, as new facilities have become available this year, the rate of gain is even larger. The annual rate of gain in local traffic has been about 20 percent, and that in toll traffic over 30 percent. Construction of new buildings has been particularly active in the Istanbul area, where six buildings were completed in 1952. Teletypewriter service, first provided in 1951, has grown steadily, and in 1952 plans were adopted to expand it further and establish teletypewriter exchanges in Ankara, Istanbul, Adana, and Izmir.

The demand for service continues to outstrip available facilities, and at the end of 1952 held orders were

A recent newspaper article by Arnold Toynbee, the historian, points out that in the ten years from 1919–28, Turkey "underwent, simultaneously, experiences equivalent to our Renaissance, Reformation, Scientific Revolution, Industrial Revolution, and French Revolution, all rolled into one." Since that period, the article continues, they have held a genuinely free election and today even the peasants, in the long run the decisive element in the Turkish population, are making genuine economic and social progress.

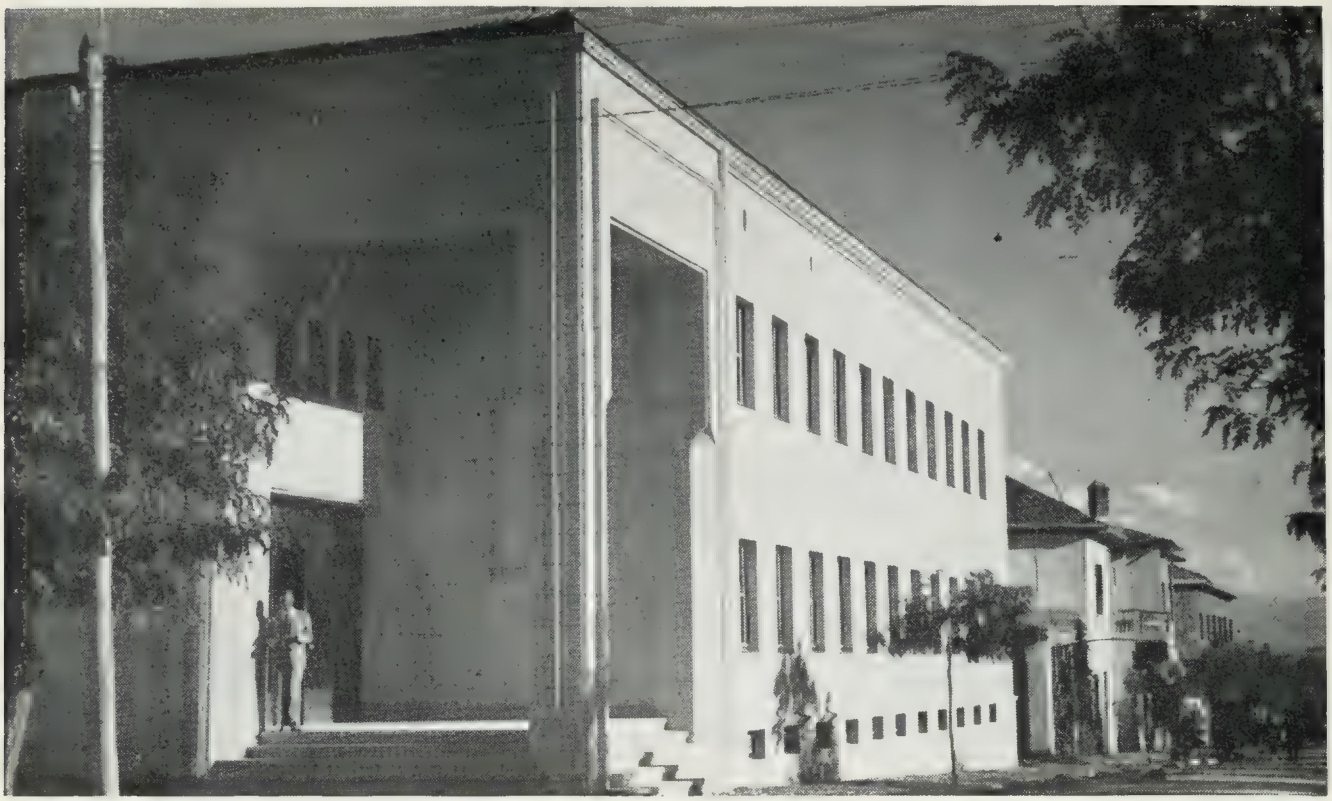
about 35 percent of working main-line telephones. Definite steps to relieve the situation have been taken, and their effects are becoming apparent this year. A major construction program is essential to meet the long-term domestic demand for telephone service, however, and plans have been drawn up for this purpose. In addition to scheduled installations of new facilities in the Istanbul, Ankara, and Izmir areas, these plans include projects for new plant at a number of other towns and the installation of point-to-point radio to supplement the wire network, particularly in mountainous and sparsely settled eastern Turkey.

During this period, the expansion of Turkish communication facilities to other countries has been particularly notable. The first addition to the single outside link to Bulgaria was the completion of a wire line to Greece in 1951 and the addition of carrier on this route early in 1952. In this way, connections can now be set up through Greece to all parts of Europe. To the east, three-channel carrier systems to Syria, Iran, and Irak are in operation.

On February 16, 1953, radio telephone service between New York and Ankara was established. At different hours of the day, the same equipment is used for service to Berne, Switzerland, and Hamburg, Germany, with connections to other parts of Europe, and to London for service to Great Britain and Ireland.

Since this project was undertaken, Turkey has become a member of the North Atlantic Treaty Organization and the improvement of its domestic telephone system and of its communications to the Western World have become increasingly important to the defense of all free nations.

Some of the fields to which the Bell System consultants have given special attention are: long-range programming of central-office expansion in the larger cities, plans for specific buildings, studies of the trunking layout in Istanbul, introduction of written operating practices, forecasts of demands for service, revision of toll rate schedules, and directory prac-



Modern telephone buildings are rising in many Turkish cities. This one is in Elaziz

tices. Inspection trips to all parts of the country have been made, with resulting specific suggestions.

Domestic Arrangements

WITH one or two exceptions, the wives of the Bell System men have accompanied or followed them, and in a few instances, other members of their families have done so. At first, the group was located in Istanbul (long famous as Constantinople), a beautiful city with many ancient mosques and other points of architectural and historic interest. Many hours were spent exploring in the city and riding back and forth on the little ferry boats that go up the Bosphorus almost to the Black Sea, with stops at little commuting settlements along the water's edge.

Now the entire group is at Ankara, 300 miles east of Istanbul on a 3,000 foot plateau, established as the capital of the Republic by Kemal Ataturk soon after World War I. Its main street is lined with modern buildings, is very well lighted, and contains a center parkway with beautiful trees and flower beds surrounding numerous statues. In the adjoining hill city of Angora, the people live in most picturesque style as they have for many centuries. Nearby are other points of unusual historic interest, and throughout Turkey new evidence of ancient civilizations constantly is being found.

Living conditions in Istanbul and Ankara are similar to those in many European cities. Some members of the group live in individual houses, others in apartments. Local transportation is excellent. Experience in shopping, with its characteristic bargaining, leads to increased skill and real enjoyment. Villagers coming into the city to sell their produce in the markets and to purchase supplies provide a most colorful sight. Particularly impressive for the Bell System group has been the unfailing politeness and friendliness of the Turkish people, and there is ample evidence that the members of the group have won their regard—and liking as well.

For the future, perhaps the most significant fact is that the ten Turkish engineers trained in the Michigan Company in 1951–2 have been placed on assignments where that training can be effectively utilized, and for the past year and a half have been working closely with Bell System men of long experience on the problems of the Turkish telephone system, typical not only of today but of tomorrow. As a result, this group will continue to apply the best in our methods after the consultants return home to the United States, and will become an effective link to other Turkish telephone men who will carry on similar methods over the years.

Helping Turkish Telephone Men to Greater Skills

Bruce E. Osgood

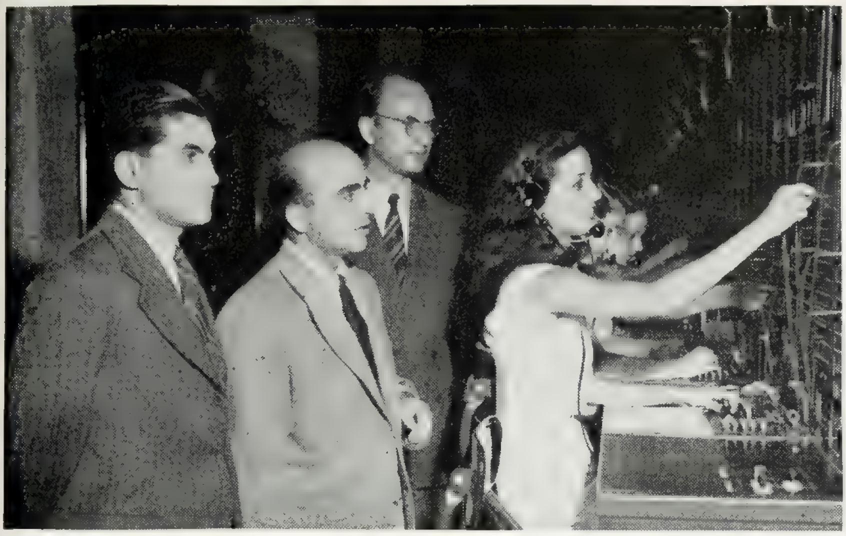
When seven telephone experts from the United States went to Turkey, early in 1951, they found that one of the greatest needs there was for more trained telephone technicians. They coöperated, therefore, in selecting ten young Turkish engineers to come to the United States for specialized training. This group arrived in New York on August 2, 1951, en route to Detroit.

The Michigan Bell Telephone Company was selected to carry out the Turkish training program because it had an interdepartmental training program for new employees entering the supervisory ranks and because it serves a great number of widely scattered small communities and thus meets many problems comparable to those which the Turkish engineers encounter in their own country.

Ten Turkish engineers arrive in this country on August 2, 1951. The authors of these articles, Messrs. Bridgman and Osgood, are the first two at the bottom of the gangway

Some interesting problems presented themselves soon after the training got under way. Uppermost in importance was the "language difficulty," as the Turks so aptly put it. A method had to be devised to encourage the Michigan Bell instructors to adjust their speaking tempo and "slanguage" to meet the needs of the Turkish engineers; for it became obvious that the innate courtesy of the Turk prevented him from asking clarification questions of his instructors for fear of insulting them. A method also had to be worked out to make regular quality appraisals of the training being given.

An intensive after-hour program was continued for the entire period of interdepartmental training, and even though it required long hours and hard work on the part of the Turks, as well as those administering the program, it contributed greatly to the ability of the administrators to analyze and adjust the subsequent training program. It is recognized that a schoolroom approach, such as this, worked a considerable hardship on the visitors, but we could find no other way to make an accurate and comprehensive appraisal of quality and understanding of the training program as it progressed.



Three of the visitors from the Bosphorus observe overseas and ship-to-shore operations

Technical subjects were covered in the latter part of the program, when the ability of the men to understand spoken English was better developed. Delaying the presentation of technical subjects until later provided time to introduce the men to telephone terminology during the evening sessions. As a result, when they began studying in the general engineering and plant departments, they were more familiar with American telephone operation and telephone lingo in general, and it is believed a much more effective understanding of these vital operations was accomplished.

The six months' training program, as originally planned, was divided into three parts, each of two months' duration.

The first part consisted of the two months' interdepartmental training program. This included a quick over-all orientation of all departments and phases of the telephone business in Michigan.

The second part included a concentrated two months' training program in these three major areas of telephone plant and engineering work:

Outside plant engineering, construction, and maintenance.

Toll line maintenance, transmission and protection engineering, radio communications.

Traffic engineering, building and equipment engineering, central office maintenance.

Part three included two months of individual assignments for all ten engineers in the operating departments. In this phase it was intended that each man would be placed on individual work assignments similar to those

Another trio appears on a television program which he was expected to perform when he returned to Turkey.

Revising the Curriculum

Before the training entered the second phase, experience indicated that it would be advisable to make some minor adjustments and improvements in the program. So the second and third parts of the program were partially combined. Some of the delegates were placed on individual assignments and others were given group assignments. Since trained telephone personnel was needed most urgently in Turkey in plant, engineering, traffic, and commercial phases of the business, these activities received the most emphasis. The training objective was to send back to Turkey as well rounded a team as possible, representing those key phases of the telephone business.

Nusret Ercil, Hayrettin Pakel, and Rifat Toplu were assigned to study outside plant construction and engineering. Vehbi Basar specialized in traffic engineering. Huseyin Cavuslar and Omer Sevkal studied central-office equipment engineering and maintenance. Cezmi Saglam studied carrier equipment engineering and maintenance. Necmi Ozgur studied commercial engineering and business office operation and was given a quick look at Revenue Accounting. Adnan Bayboru and Turhan Zirh were given somewhat more general training.

All of the specialized training was given at various locations in the Michigan company area except for the following: one week at the Chicago plant of the Automatic Electric Company; one day at the Murray Hill unit of the Bell Telephone Laboratories; one day at the New Jersey plant and laboratories of the Federal Telephone and Radio Corporation; one day at the Kearny plant of the Western Electric Company; one day in the Long Lines Department of the American Telephone and Telegraph Company in New York; and two days at the Spartanburg, South Carolina, pole treating plant of the Taylor-Colquitt Company.

From the first day after the arrival of the Turks, life for them and for those who came in contact with them was a rich and never-to-be-forgotten experience. On the very first day in New York, a woman approached our red-headed Turkish engi-

The entire group pauses at the telephone exhibit at the Museum of Science and Industry in Chicago neer, Turhan Zirh, and asked him the location of the subway entrance. He pointed to the one we had just walked by and she quickly said, "Thanks, I'm a stranger in town."

We were told that it was proper, when introducing our Turkish friends to people, to use their first names and add *Bey* on the end: Turhan Bey, Adnan Bey, etc. The first time we did this, one of our officials remarked, after he had been introduced to several of them, "Oh! I didn't know you were all brothers."

Turhan Zirh had another first when, after a few days, he came in one morning and said, "Now I am an American." Noting the inquiring expressions, he added quickly, "Last night for the first time everyone in my dreams spoke English to me."

Back home again, two of the Turkish engineers (left and second from right) join with three of the Americans and with other Turks at a new repeater hut near Ankara

Helping Us Understand Turkey

The Turks did an outstanding job of trying to help America to understand more about their country. They made many luncheon talks. They were interviewed by many newspaper writers. They appeared on two television programs, once for 45 minutes and once for 15 minutes. In fact, they were trying so hard always to speak English that one of them, while rehearsing for one of the television programs, was asked to repeat in Turkish what he had just said in English and was so taken by surprise that he had to ask one of his countrymen to help him do it. Later he said he had got his mind functioning so much in English that he found it difficult to translate English to Turkish.

The Turks were quite surprised to learn that we have a "slight" variation in language in different parts of our country. After their meeting with Mr. Craig, President of A. T. & T., and Mr. Dumas, executive vice president, and formerly President of Southern Bell Telephone Company, they were eager to know what part of the country Mr. Dumas came from. One of them said, "His speech was so smooth and so soft but I had to pay attention closely to understand him."

At work and at play the Turks made every minute of their time do double duty. They applied themselves diligently to learn everything they would need when they got home. They cemented relationships with many Americans. The effect of that good will they have left behind will be multiplied many fold in the future. They have done much to bring two friendly republics closer together with increased mutual understanding and admiration one for the other.

At the end of the six months' training period our Turkish friends turned their faces toward the East and home. They were filled with enthusiasm and high hopes for utilizing the experience gained with Michigan Bell. They were fully cognizant of their country's needs for better communications, and were restless to return and put into operation all their plans and dreams for the future.

Before the visitors returned to Turkey, early in 1952, they met with Mr. Cleo F. Craig (left), President of the American Telephone and Telegraph Company, in New York

A Discussion of the "Social Responsibility" of the Bell System High-Lights the Contributions which the System Has Made to Our Country and Its People

People As Telephone Users, Workers, and Investors

John M. Shaw

Note: Not long ago an eminent sociologist came to the American Telephone and Telegraph Company and said, in effect: "I am working on a series of lectures on the social responsibility of American business. My research so far has brought me into contact with a great many students of the subject, and the Bell System is one of the business enterprises most frequently mentioned as having very special obligations in the public service. I'd like to have your own ideas about your social responsibility and how you go about meeting it."

The job of answering this all-encompassing question was assigned to John M. Shaw, Assistant Vice President, A. T. & T. Company. He prepared some informal notes as a guide to his discussion. We asked him to recast them in a form suitable for publication. EDITOR.

TO GET the right perspective of the Bell System's "social responsibility," and how it is being met, it may be helpful to high-spot the job it has done for the American public over the long years of its history. And this review may be better understood if we think of the public in terms of (1) the people who use the telephone, (2) the people who give the service, and (3) the people who invest their savings in the business. All these people are members of the American public.

The People Who Use the Telephone

FROM one "toy" telephone, the Bell System has developed a machine that has changed for the better the entire scheme of life in America. Its ally in this progress has been the large group of independent telephone companies that connect but do not compete with Bell System lines.

The telephone is now universally used.

It has made family life more comfortable and secure, and two American homes in every three are now telephone-equipped.

By expanding the range and increasing the speed of communication, the telephone industry has stimulated the processes of every other institution that serves the people, be it industrial, cultural, or governmental. The telephone's contribution to the American economy is incalculable.

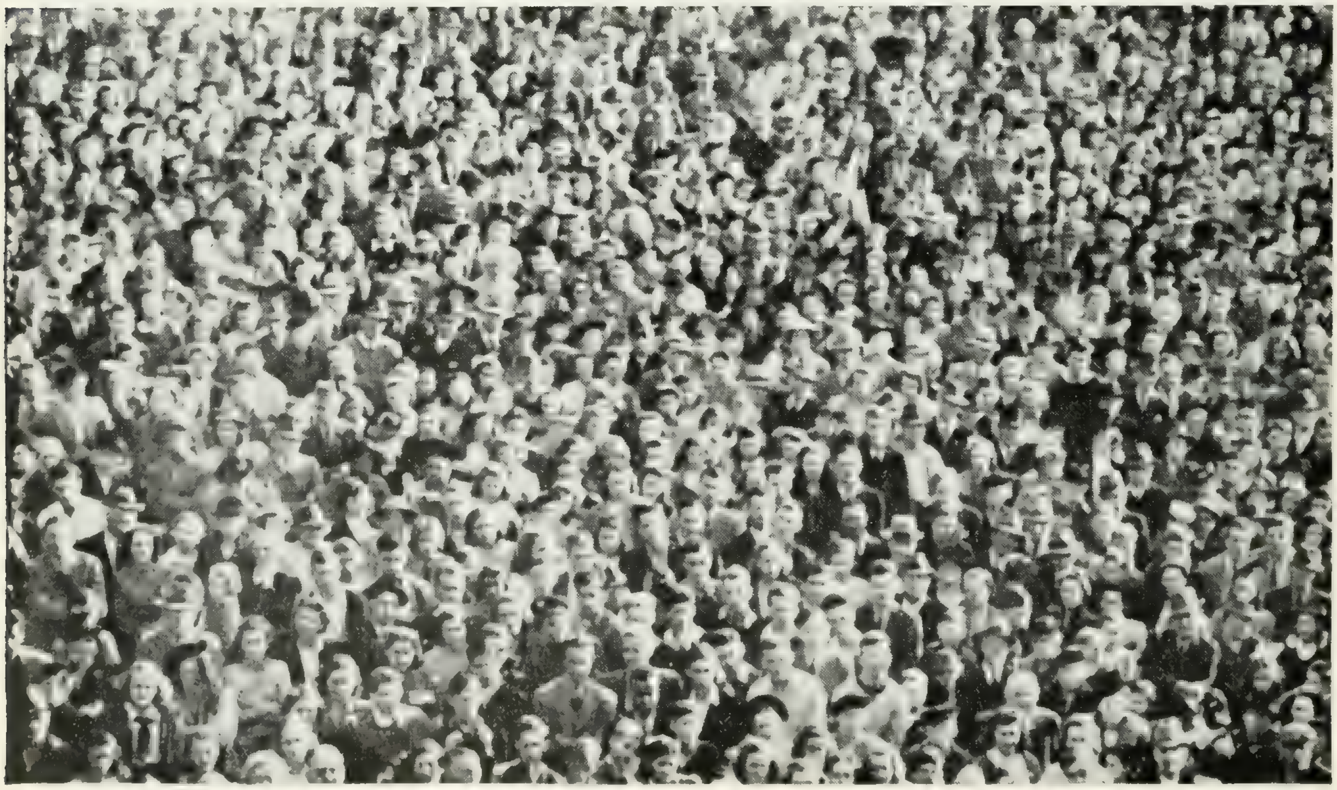
The number of telephones in America has doubled in the last ten years. There are now in this country more telephones than in all the rest of the world combined: 50 million, four fifths of which are operated by the Bell System.

We are especially proud of the job that has been done in rural areas, where the costs of giving the service are high and the value of the telephone is not always fully recognized. More than two million telephones have been added by the Bell System in rural areas since the war, so that today in the 32 most prosperous states 60 per cent and more of the farms have telephones. Nothing in the world approaches this development.

To achieve this nation-wide growth, the Bell System has spent a billion dollars a year in new construction for the past eight years. Much of this money has been provided by members of the public willing to entrust their savings to those who administer the telephone business.

The service provided over this expanding system of telephone lines has been steadily improving. People can hear better over them. Calls are put through more quickly. The service is more dependable.

Four-fifths of all Bell telephones are now dial, and two-thirds of all long-distance calls are dialed by the operator. We are moving steadily



The people who use the telephone

toward the day when any telephone in America can be dialed direct from any other.

Meantime, the price of telephone service has been going down in terms of the ability of the people to pay for it. At a time when the cost-of-living generally has doubled, including the cost of operating the telephone business, telephone rates have gone up less than one third.

VAST contributions have been made by the Bell System to other communications services which resemble the telephone and to some extent have been the product of telephone research. These include radio, television, and the talking motion picture. The latest development of Bell System research that is likely to have a profound effect on all these activities is the transistor. Like the thousands of other telephone patents, the transistor is made available upon reasonable terms to anyone who wants to use it.

Much of the advance in telephony is due to the close working relationship between research, manufacturing, and operation. The research-manufacturing members of the Bell System team were called upon by the government during the last war to undertake no less than twelve hundred military projects, including radar, guided missiles, atomic energy, and many other devices having great significance for the preservation of the free world. This close and important relationship continues.

From the outset, the Bell System has operated without the aid of government subsidy—the device by which the public has so often found it necessary to encourage the development of enterprises of this kind, in this and other countries. On the contrary, Bell System services are not only self-supporting in our economy, but are actually making a contribution to the support of the government, through taxation, equal to about thirty per cent of all telephone revenues. The telephone users, in other words, are apparently willing to pay not only what it costs to provide them with telephone service, but thirty per cent more.

The American public has a very effective way of expressing its approval or disapproval of the business enterprises which serve it. It simply uses or declines to use the product or service made possible by the enterprise. By its generous use and demands, we think the American public itself has answered for us the question of how well the Bell System has met its social responsibility from the point of view of the telephone users.

The People Who Give the Service

THE BELL SYSTEM gives employment to some 700,000 people. Despite the rapid advance to dial operation, this is twice as many as were employed in 1929.

Telephone growth has also created many more jobs in other industries. The by-products of telephone research have created still more.

Telephone employment has a high degree of continuity, and the business is operated so as to make this possible. Technological improvements are introduced with full recognition that other jobs are to be found for all permanent employees affected,

The people who give the service

and for our success in this we have won praise in the highest quarters.

A serious strain on the Bell System's continuity of employment was experienced in the depression years of the 1930s. As telephones were disconnected, part-timing and made-work plans were introduced. Force losses resulted, not so much because employees were laid off as because new employees could not be hired for jobs that did not exist. Except for this relatively brief span of years, the number of jobs available in the Bell System has steadily increased as the System has grown.

Wages have kept pace with those paid for similar skills in the same community, wage rates having doubled since before the war. Working conditions have been steadily improved. It is always gratifying to hear the friendly and favorable comments of visitors to telephone buildings about the pleasant atmosphere of the offices and equipment rooms in which telephone people work.

Twenty-five years before the public made government social security compulsory, the Bell System had a benefit plan that included one of the earliest and best pension systems in American industry.

Promotion from the ranks is a constant process, from the lowest job to the highest. Discrimination and nepotism are so frowned on by tradition that telephone companies have been singularly free from these evils.

That telephone companies are recognized as good places to work is borne out by the fact that employees hold on to their jobs and bring their friends and relatives into the business. The channel through which most new employees come into the telephone business is through other employees.

The figures of the U. S. Bureau of Labor Statistics show that turnover in the telephone industry is about one half that of all manufacturing industries.

If we believe—as our sociologist friend did—that part of the Bell System's social responsibility is to provide a place where members of the public can work constructively together and earn a living, then it would seem we are meeting it rather well.

The People Who Invest Their Savings

The Bell System is owned by the people who buy shares in the American Telephone and Telegraph Company. There are more than 1,250,000 of them, in all parts of America.

Regular dividends have been paid by AT&T for a great many years. There has never been an extra dividend nor has the stock been split. From the surplus built up in the prosperous years, it has been possible to maintain the dividend even in years when it was not fully earned.

The early years of the decade

The people who invest their savings

1925–1935 were good years, in which many industries made high profits and paid them out in cash and stock dividends and split the stock. AT&T paid its regular dividend and saved the rest. When the depression came, AT&T was able still to maintain its regular dividend by drawing on its surplus. In retrospect, it does not seem that we would have met our social responsibility for the long pull if we had cut that dividend, at the time of greatest need, and thus shaken the confidence of those who must be relied on to provide the tools without which no service could be given and no jobs provided.

Time has shown the wisdom of this consistent dividend policy, and the public has given its seal of approval in the most emphatic way, by providing more than six billion dollars of new capital since the war. More than half has been in the form of capital stock, so that the business has been able to go forward without accumulating a destructive load of debt.

If part of our social responsibility is to provide a place where people can put their savings to work productively and earn a reasonable return, it would seem that we are meeting it.

AS FOR THE FUTURE, we approach it with advantages that our predecessors did not have. Chief among these is their own example, which has given us a tradition of public service that guides our every action. Basic in that tradition is the recognition that we prosper only as we recognize what our friendly inquiring sociologist called our "social responsibility."

Placing of long distance calls by number has long been encouraged . . . for the customer's benefit as well as for the company's. The value of calling by number is well demonstrated by the following dialogue of an actual call placed in St. Louis a while back:

"I want to call my son."

"In what city is your son located?"

"Utah, Nevada."

"Are you sure that is Utah, Nevada? Utah and Nevada are names of states."

"I sure think so."

"What is your son's name?"

"Tommy Jones."

"Is the telephone listed under his name?"

"No, he's in a camp."

"What is the name of the camp?"

"Camp Marines."

"Do you know what company he is in or his rank?"

"No ma'am."

"How do you address his mail?"

"I just write U.S.M.C."

"Is he an officer?"

"I don't know, he might be a corporal or a sergeant by now."

"I'll try to locate him for you, ma'am, and call you back."

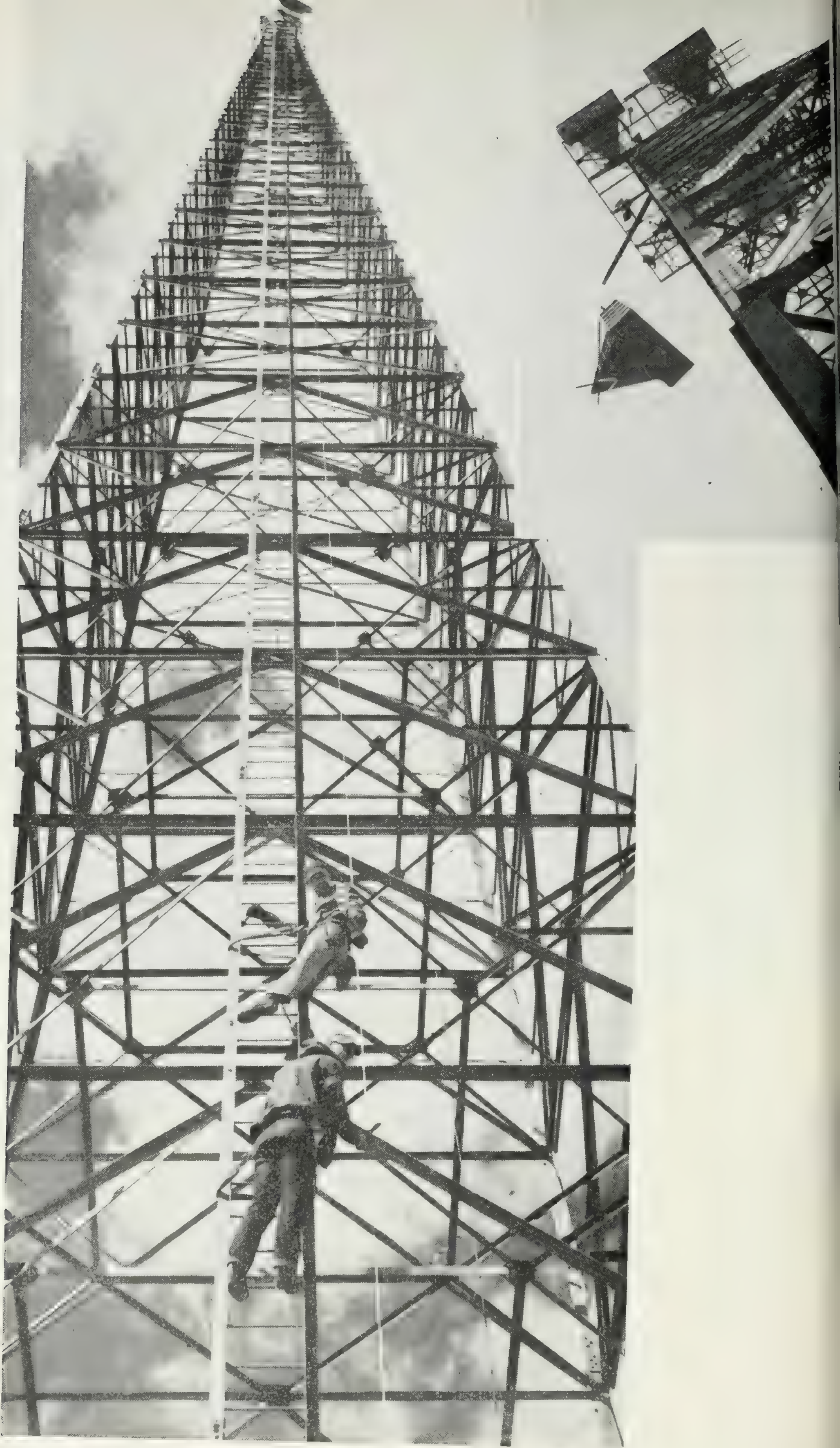
And she did. It was a tough job, but switchboard sleuthing disclosed that the destination should have been Hawthorne, Nevada, U. S. Marine Supply Station. Mission accomplished. Call completed.

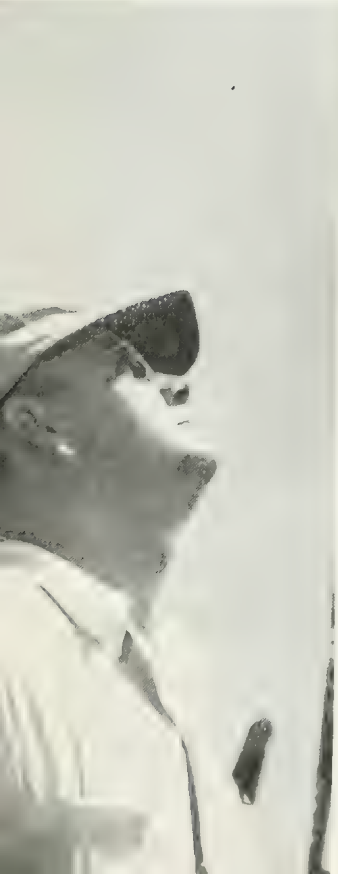
(*From an employee bulletin of the Southwestern Bell Telephone Company*)

Towers and Beams

Radio relay tower and open-wire toll line both serve important routes

THE ART of communication advances—and history repeats itself. Three decades and more ago, telephone lines were being expanded to carry the newcomer, radio broadcasting, not only from coast to coast but into communities large and small throughout the nation. Now, in these still relatively early days of television broadcasting, a somewhat similar development is taking place in Bell System television program facilities—of which radio relay forms the larger part. Beamed from tower to tower across the country with the speed of light, television images as well as telephone messages are transmitted over a network which has grown to more than 60,000 channel miles of radio relay facilities in the last five years. Today the major activity is in providing extensions to the "backbone" routes, to carry the programs into more and more communities in many parts of the country. The map two pages over shows how much the network has grown—more than 19,000 channel miles—in the past nine months, and the pictures give some indication of what is involved in making these newest facilities for telephone and television service available to more people in more places. And now the art progresses further—as witness the transmission of Pasadena's Tournament of Roses parade across the continent on January 1 *in color.*





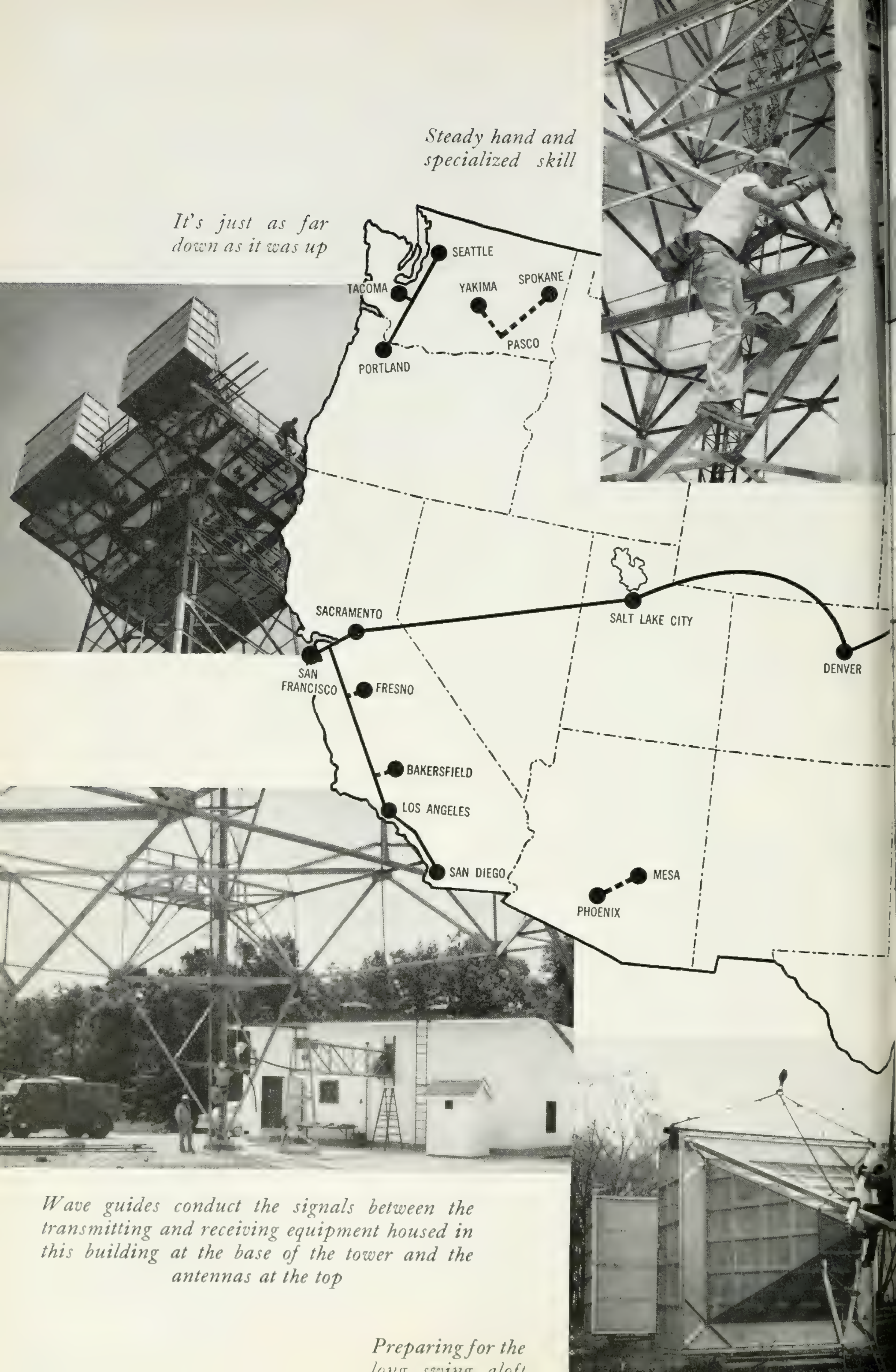
Radio relay facilities are being extended throughout the country. Above: A radio relay tower with dish antenna on top splits the sky on a recently completed route in Wisconsin. Left: A construction man gazes aloft at a tower going up in Georgia. Upper right: a lens antenna is hoisted into place atop a New Jersey tower

Access to radio relay equipment at the towers is essential. The road seen above was built for that purpose in Ontario, Canada, while it was possible to locate the tower at the right beside a highway in Georgia

Lens antennas are big, heavy, and difficult to handle. The truck driver is watching signals in the mirror in his truck cab as he winches one aloft. That one is in New Jersey; the array of four is in Tennessee

Steady hand and specialized skill

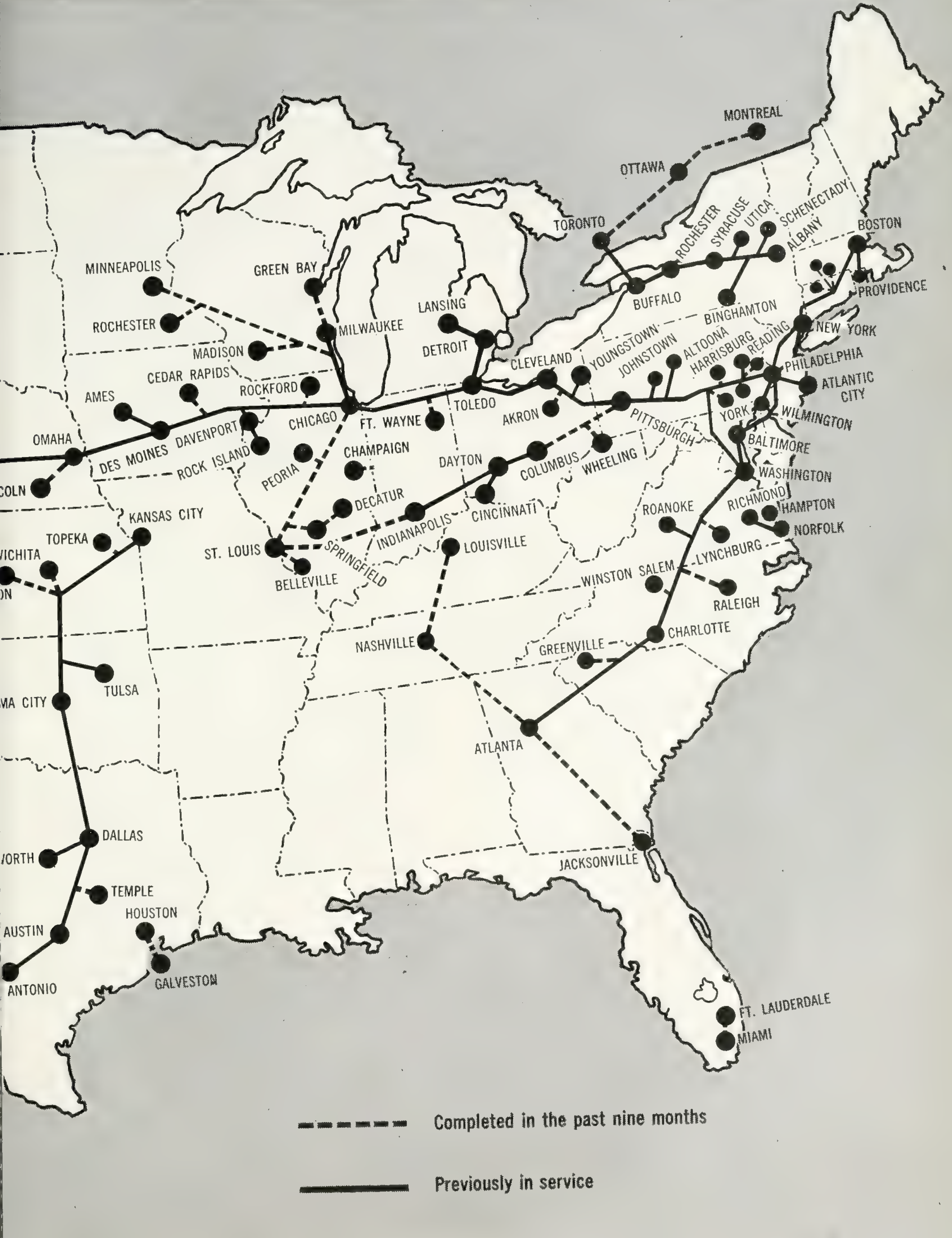
It's just as far down as it was up



Wave guides conduct the signals between the transmitting and receiving equipment housed in this building at the base of the tower and the antennas at the top

Preparing for the long swing aloft

BELL SYSTEM BROAD BAND RADIO RELAY ROUTES December, 1953



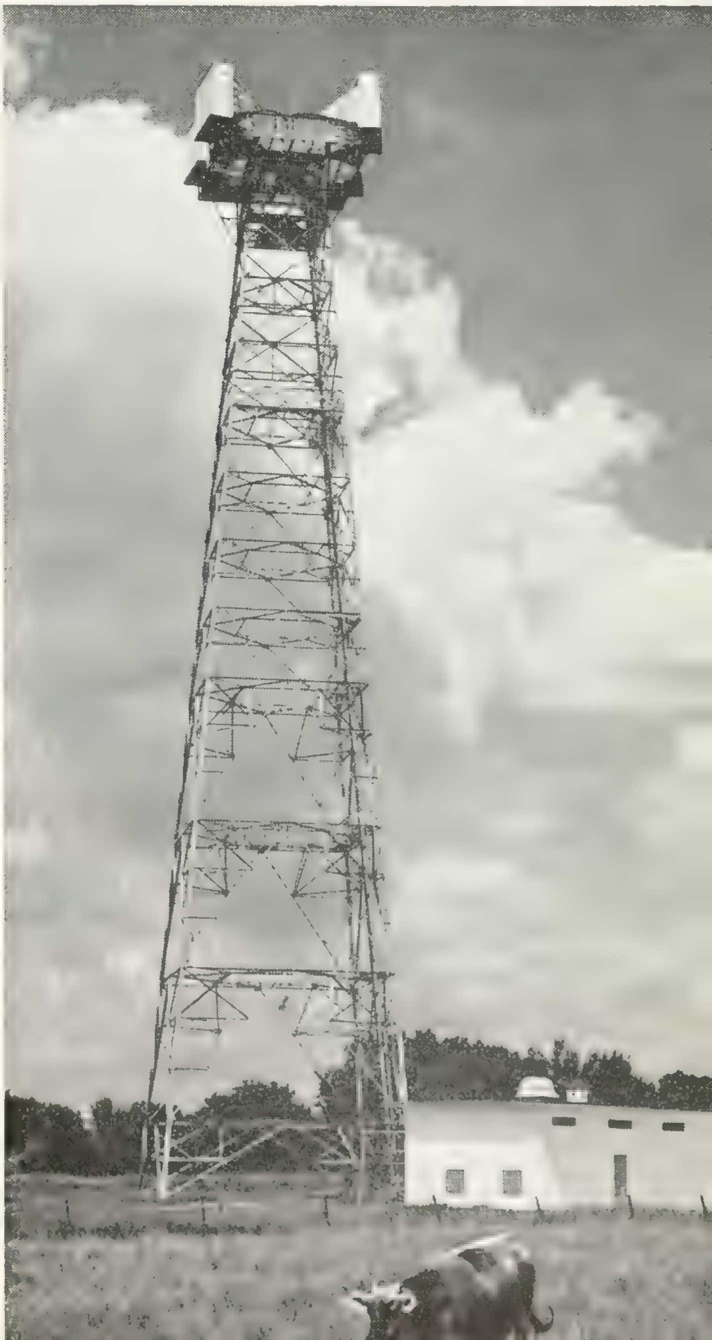
This radio relay station for rural service handles telephone calls to and from an isolated industrial enterprise in Nevada. The station at the right, on Mt. Blyn, Wash., speeds telephone calls across the waters to Victoria, B. C., replacing submarine cables

Left: Temporary arrangement of radio pick up equipment in Boston for transmission of motion pictures, flown from England, of Queen Elizabeth's coronation. Below: Portable radio apparatus on a roof-top in New York City

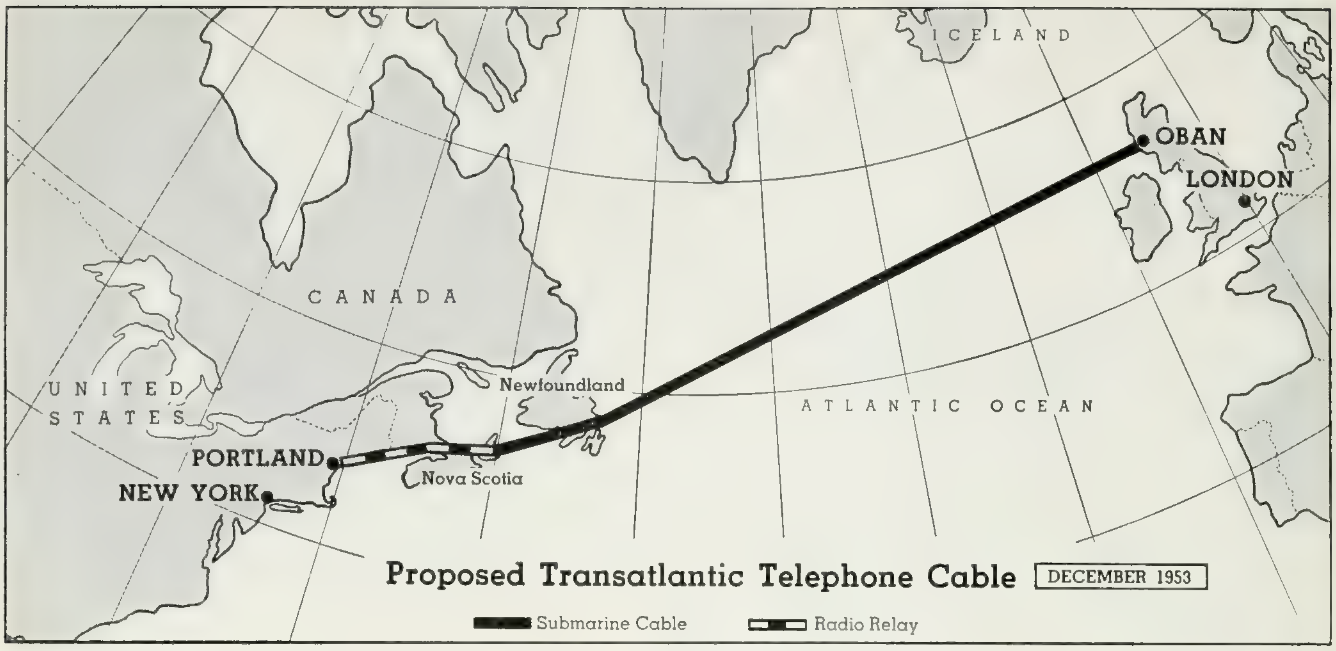
Features of the American Scene

ntennas on different levels are sometimes needed to avoid reflection of signals

Tower and antennas appear through a frame of foliage



They stretch their spidery framework to the sky



Proposed Transatlantic Telephone Cable DECEMBER 1953

Transatlantic Telephone Cable Planned

The Long Lines Department of the American Telephone and Telegraph Company announced plans last December 1 to construct the first telephone cable system across the Atlantic. The transatlantic portion of the system, with its many built-in vacuum tube repeaters, will be 2,000 nautical miles in length and will be laid in depths up to three miles on the ocean floor between Scotland and Newfoundland. It will then connect with another submarine cable extending 300 miles westward to Nova Scotia. From there, a 350-mile overland microwave radio-relay system will be built to carry the transatlantic circuits to the United States border, where connections will be made with the Bell System network.

The cable system will have capacity for 36 telephone circuits, with a group between New York and London and another group between Montreal and London. At the gateway cities, the circuits will connect with the telephone systems of the respective countries. These cable circuits will supplement transatlantic radiotelephone circuits, which include 12 now in regular use between New York and London as well as others to various transatlantic points.

Each deep-sea repeater employs three vacuum tubes and is housed in a flexible copper tube seven feet long and 1½ inches in diameter. This is supported by steel rings to form a structure that is built into the cable and appears as a tapering bulge. This design permits the repeaters to pass through the cable ship's gear along with the cable, so that laying will be orderly and uninterrupted. Such devices were developed several years ago and have undergone successful trial between Key West and Havana since 1950. There will be over 100 under-water repeaters on the transatlantic segment of the proposed system. The vacuum tubes used in these repeaters have been under development for years and have withstood both laboratory and under-water operating tests of the severest kind. The voice currents will travel along coaxial conductors, which will be insulated by a solid layer of polyethylene. Power to operate the vacuum tubes on the ocean bed will be fed in from both ends of the cable

(*Continued on page 248*)

The Transmission Engineer's Battle against the Two Ds, And Other Aspects of His Constant Effort to Make Talking Clearer and Cheaper—as Explained by One of Them

DB Rampant on a Field Of Azure

Harold R. Huntley

EVERY Bell System company harbors a group of uncommon folks who are known as transmission engineers.

To all outward appearances these transmission engineers are normal human beings. They are practically indistinguishable from the rest of humanity except for one thing: when they are working—and only when they are working—they talk a different language from the rest of the human race. At other times they talk what passes for English, and you can only get a clue to their working language if you ask one of them to explain to you what he does for a living. I recommend against it.

These poor fellows continually rebel against this language barrier and they are continually trying to make other people understand what they are talking about because, you see, after all, they *are* human and they don't like to be shut off from communication with their fellow man, particularly since communication is their business.

By this time you must have surmised that the reason I can talk so authoritatively about these peculiar people is that I am one of them. This article is just one more attempt of a long line of such attempts my fellow transmission engineers and I have been making to try to tell what transmission is, where we have been in this field, where we are now, and some of our hopes and aspirations for the future.

What Transmission Is All About

THERE IS a general impression among us in the telephone business that the principal reason for a person's making a telephone call is that he wants to *talk* to somebody else. If this impression is correct, then how well people can talk on a telephone connection is a very important part of the telephone business. And the

"*. . . as a matter of course . . . you had to shout*"

things that affect how well people can talk over telephone connections are an important part of transmission—and transmission is what transmission engineers work at.

Now people in general have two peculiarities which are very important in connection with this talking business. For one thing, they always want something better than they have now. If it were not so, we would all drive our automobiles till they were no longer serviceable; as a matter of fact, there probably wouldn't be any automobiles—perhaps not even a "surrey with the fringe on top."

In the second place, they want to get their money's worth—and, if possible, a little to boot.

And so it is with transmission. Thirty years ago, only in an emergency would you even have thought of trying to call your cousin who has a chicken farm just outside of Petaluma, California—unless you lived in or near Petaluma. And, if you did call, you would have taken as a matter of course the fact that you had to shout. Fifteen years ago you would have tried it on much less provocation; and, if you had a good, clear conversation, you probably would call up the telephone manager and confide to him that maybe the telephone was here to stay after all. Now you don't even have to have a good reason to call; and if you don't get a bang-up talk—!XX*-!X!XX???!! And 25 years from now you will probably expect a bang-up talk without even having to lift a handset.

Along with improved service, talking must be kept a bargain. And it can't be a "luxury" sort of bargain—excellent if one can afford it. It must be such a good bargain that everybody can afford it and think he is getting his money's worth—and then some.

This, then, is what transmission is all about: to provide the ability to talk easily on a wide variety of connections; to continually improve this ease of talking as time goes on; and to keep it a bargain.

How Transmission Work Is Done

THE TRANSMISSION ENGINEER works with many complex tools, but his over-all concern is with two things: DBs and dollars. And therein lies his language difficulty.

The dollar part of his language is easy to understand; everybody knows—or thinks he knows—about dollars. Dollars are nice things to have coming in but bad things to have going out.

The DB is another thing. Later on I will attempt to tell something about

DBs, but let's put off this agonizing job as long as possible. For the moment please be content with the statement that the fewer the number of DBs in your connection, the better you can talk.

If the transmission engineer could forget about the dollars and think only of the DBs, his life would be very simple and he really wouldn't care whether or not new things were developed or whether or not anybody understood him. For example, if dollars didn't count, the transmission engineer would simply add enough copper to his circuits to make them talk the way he wanted them to. It is true that for transcontinental circuits he would have to use enormous conductors, and he probably would have a little difficulty spanning the oceans, but at least for the shorter circuits he could trade dollars for DBs very successfully.

But his problem is not that simple. He has to get more and more of the DBs out because people always want something better; but he has to be very careful about how many dollars are put in, because people are not going to place many calls if they cost too much.

So our transmission engineer fights his battles against the two Ds—dollars and DBs. And he has been reasonably successful in the past: not so successful that he can rest on his oars, but successful enough so that he is optimistic about the future.

His greatest success has been in talking over long distances. In this field he has greatly improved the transmission and he has beaten the price rise. No longer is talking from, say, New York to San Francisco a struggle to see how loudly and long one can shout and how acute one's hearing is—one just talks and listens naturally. And one can talk on such a connection for three minutes for $2.50, whereas 30 years ago it cost him $16.50.

Now, talking over 3000-mile distances is glamorous, and nobody can deny that the transmission people have been pretty successful at it. But there's a lot more to this transmission business. People also want to talk over 300-mile and 30-mile and 3-mile distances. In fact, for every 3000-mile call there are at least a hundred 30-mile calls and thousands of 3-mile calls—and therein lies the present and future transmission problem, at least for the next few years.

So while our transmission engineer keeps a weather eye cocked on the long-haul end of the business, he is pretty well preoccupied with his struggle in what we call the "short-haul" end of the business. This short-haul business is tough: DBs come out only with great difficulty but dollars can go in very easily; there is no glamour in it, and it doesn't make the headlines. He has not been able to beat the price rise in this part of the business; the best he has been

"Now you don't even have to have a good reason to call"

able to do is to keep the cost of the circuits from going up as rapidly as prices in general have risen.

But if the problems are great, the stakes are even greater, just because there are so many calls of this variety. Let's look at this matter of length versus dollars more closely.

The Shorter the Tougher

In order to get the right perspective on this short-haul problem and how we believe it will be solved eventually, I am going to have to get close—but not dangerously so, I hope—to the cage marked "Danger—DBs—do not disturb or attempt to feed." And in doing so, I am going to go back to a couple of fundamentals.

In the days before electronics, it was generally true that the longer the circuit the *more it cost per mile,* if it were to give the same performance. To illustrate: a circuit, say, 10 miles long had to have wires of a given size to produce not over a desired number of DBs in the 10 miles. Now if we wanted to go 20 miles, we obviously would have to have wires twice as long but, in addition, if we wanted to have the same number of DBs as in the 10 mile circuit, the wires would have to be about twice as big. Thus, to keep the same performance at twice the length, we had to use four times as much copper (twice as much per mile times twice as many miles).

In the electronic era the reverse is in general true for everything but the very short circuits, say, up to five or ten miles. That is, the longer the circuit the *less it costs per mile* for equal performance. And this requires a little explaining.

In this era, the transmission engineer no longer uses the brute force method of putting more copper in to get DBs out. He uses electronic amplifying and carrier gear. Thus:

1. For the circuits of moderate length he can use as small wires as he wishes and can offset the DBs thus added by taking out DBs by means of amplifiers.
2. For the longer circuits, he uses carrier,* which divides the cost of the base plant—the pole lines, the cables, the wires, the radio systems, etc.—among many circuits.

Once he has done this, the costs per circuit of the base plant are reduced and he can take out as many DBs as he

"*. . . fights his battles against the two* Ds*—dollars and* DBs" wants to by turning knobs (with some limitations which are too abstruse to be discussed here), and operation with only a few DBs in the circuit doesn't cost any more than operating with lots of them. (A parallel is your own radio set. Once you have bought it, your power bill is not affected by where you set your volume control knob).

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* See "Carrier Is King," Magazine, Winter 1949–50.

Thus, once the proper electronic equipment is added to a circuit, there is no longer any fixed relation between the DBs and the dollars in the circuit; the DBs and the dollars are affected by different things.

If this be true, then why does the dollar problem get tougher as the circuits get shorter? Simply because the electronic equipment costs money. And it is obvious that if one is to have fewer total dollars in his circuit, he must save more in base plant costs per circuit than he spends for the gear he adds.

Now, the major cost for the equipment he adds is at the *ends* of the circuits, while the base plant cost savings are on a per-mile basis. So, if the circuits are long, the base plant cost savings are big, and more than offset the costs of the terminal gear. As the circuits get shorter, the base plant savings get smaller, and, since the costs of the terminal gear do not go down proportionally, the total cost per mile go up.

In summation, then, the problem of getting low dollars and DBs per mile gets tougher as the length of the circuits decreases. But because of the high stakes, our transmission engineer has set his sights on overcoming these problems even though they seem inherent. And he sees over the horizon ways of doing it.

". . . sees over the horizon ways of doing it"

He may not see these problems licked in his lifetime, but he is confident that some future generation will.

Why?

How To Do It

ALL THAT IS NEEDED to solve the short-haul problem is to get the costs of making and using amplifying and carrier and radio equipment down much lower than at present. And our transmission engineer believes it can be done. Here are his reasons.

In our economic system there is a base cost below which we cannot get. This cost is the cost of the raw materials which go into what we make.

But aside from a few things like coal, crude oil, etc., the final cost of a product is largely determined by the cost of fabricating it, handling it, and putting it to use. For some highly precise products—like, for instance, a fine watch movement—this cost may be hundreds or thousands of times the cost of the raw material. Electronic gear is also in this category.

If the cost of the finished product is hundreds or thousands of times the cost of the raw materials which go into it, there is almost unlimited opportunity for reducing costs and the only problem is how to take advantage of this opportunity. There are several ways to reduce costs under these conditions: one of them is quantity production, another is skill born of long experience, another is new materials, and still another is sheer brains and ingenuity.

Our transmission engineer knows that as he applies electronic gear to shorter and shorter circuits, the quantities involved will be much greater than have ever been used before and this fact alone will reduce the costs.

He also realizes that while the electronic business is not an infant any more, it has not reached the full stature of manhood and there is still much to be learned about how to use it to the best advantage. He knows, therefore, that as he goes ahead he can improve his skill in integrating electronic equipment into his plant and that this will also enable him to get better results for fewer dollars.

Materials, Ideas, Organization

AND WHILE he doesn't see anything in the way of new materials as revolutionary as the vacuum tube was when it came on the scene, he does see many things which may well be as important in total as the vacuum tube in keeping DBs and dollars down. For example, there is the transistor, which bids fair to open a whole new field of miniaturization—which will make the gear cost less and will let him house large numbers without breaking the bank for new buildings and power plants. There is a new series of magnetic materials known as "ferrites" (they are ceramics made up of iron rust and other common ingredients suitably treated) with which to make smaller, cheaper, and better magnetic cores. There are new materials which can be used to make smaller, cheaper, and better capacitors. There are . . . . but why go on?

But above all, there are new ideas: new applications of brains and ingenuity which may and probably will radically change the design and application of electronic gear. I cannot possibly take the space to describe them, but, for what it is worth, a few of them are negative impedance amplifiers, mechanical filters, magnetic and capacitive amplifiers, etc. etc. etc.

And our transmission engineer does not stand alone in working out his destiny. He has an organization in New York—the O. & E. Department of the A. T. & T. Co.—to whom he can tell his needs and his aspirations and a large part of whose responsibility is to translate these needs and aspirations into the general kinds of things which need to be invented and made. In back of the O. & E. Department is the Bell Telephone Laboratories, a large part of whose job is actually to invent specific things that are needed—or use somebody else's inventions—and to develop them for manufacture. And then he has the Western Electric Company, whose job it is to make—or have made—the things which have been invented.

He sees himself, then, as a member of a team which has solved many tough problems in the past and which he is sure can and will solve the tough problems of the future. With such an outlook, how can he help but be optimistic?

Now you know all about transmission except for the DB.

And, if you have read this far you are in one of three groups:

1. You don't know what a DB is and you don't care.
2. You don't know what a DB is and you'd like to know.
3. You know what it is.

Groups 1 and 3 should stop reading right now, because the rest of this is directed solely to Group 2.

Why Is a DB?

SOMEONE has said that the only things we know are the things we can measure. And so in transmission we must have some method of measuring how much speech loses or gains as it goes over a circuit. The measuring stick we use is called the DB. (In the accompanying box there is a brief description of the DB and how it got its name.)

Now the thing that makes the DB hard to understand is that it is tied to "ratios"; that is, a given number of DBs means a given *ratio* of powers. This is different from most measuring sticks which we use, since they are in absolute terms and are what the mathematicians call "linear." Let me illustrate the difference between a DB kind of measuring stick and the linear kind of measuring stick.

Dollars are a familiar commodity measured on a linear basis. $2 will buy twice as much as $1 (at least approximately). But imagine, if you

THE DB

The term DB is an abbreviation of the coined word "decibel." A decibel is one-tenth of a bel. The mathematical expression is:

$$\text{DB} = 10 \log_{10} \frac{P_2}{P_1}\text{: where}$$

$\frac{P_2}{P_1}$ is the ratio of powers being compared.

The name bel was derived from the name Alexander Graham Bell, the last "l" being left off to avoid confusion with other uses of the name Bell. The reason that decibels are commonly used rather than bels is that the bel is an inconveniently large unit and using it would be something like measuring the size of a rug in miles instead of feet and inches.

The DB is the latest of the series of units which have been used in the past in measurements of transmission.

Many years ago the transmission unit was the so-called "mile of standard cable" (which was roughly the same as a mile of 19 gauge non-loaded cable pair), and the transmission loss of, say, a piece of equipment was measured by comparing it with the number of miles of standard cable which would produce the same over-all effect on speech.

The next step was taken when testing instruments were developed which could be used instead of talking tests. The unit then used was the loss of a mile of standard cable at the specific frequency of 800 cycles and it was usually known as the "800-cycle mile."

Still later, the measuring unit was divorced from any particular type of plant and was based on power ratios. This unit was called a "Transmission Unit" and abbreviated TU. The DB has the same magnitude as the TU. Adopting the DB, therefore, required only a change in name.

Sometimes the DB is applied to voltage or current ratios—in which case the formula is changed. However, this is permissible only under certain conditions and should be attempted only by an expert.

will, that we were in a peculiar sort of economic system in which the purchasing power of dollars went up or down not directly but as some other function. It might be, for example, that if \$1 would buy 1.26 units of something or other, \$2 would buy 1.26 × 1.26 = 1.58 units and \$3 would buy 1.26 × 1.26 × 1.26 = 2.00 units; and so on. (If you look at the DB table you will see why I picked this particular scheme with 1.26 units as the starting point, and how we could reconstruct this table by this kind of process.)

While such a method would look pretty silly applied to dollars—or inches, or bushels—it is exactly the plan that has to be applied in measuring transmission.

Why? Aren't we in the business of transmitting electrical power to a listener's receiver? And, if so—and we are—why don't we use the ordinary method of measuring the amount of power we transmit and deliver; that is, why don't we use watts just as a power company does?

One of the answers is that while we are in the business of transmitting electrical power to a listener's receiver, we do not generate the power which we undertake to deliver. This power is generated by a talker at the other end of the connection, and our job is to deliver enough of it to the listener so that the sounds which come out of his receiver are loud enough so that he hears clearly. We do not know how much power there is to start with in any particular case, because talkers vary tremendously in the amount of power they put out, so that there is not much sense in trying to measure it in the same terms as the power company does in measuring the power which they send out from a generating station. (Incidentally, your telephone bill would look peculiar, to say the least, if it read \$—— for —— watt-hours for a call to Petaluma, Calif. You see, we are not interested in the power as such—we are only interested in its ability to carry information. You may not even be interested in the information—but that's beside the point.)

So what our transmission engineer is concerned with is delivering to the listener a large enough proportion of the power which the talker puts out so that the listener gets good, clear sound out of his receiver. In other words, he is interested in the *ratio* between the power he delivers to the listener and the power the talker puts out. It's as simple as that.

IT ALSO HAPPENS that the laws which nature has set up to govern what happens to power when it is transmitted over a circuit also work on a ratio basis; that is, the effect of two things connected in tandem is the product of the effects of each of them individually. This is another reason why we use ratios as a fundamental in telephone transmission.

Now I still haven't told you why we use DBs instead of ratios about which I have said so much. I will let you in on a secret. In spite of all the scientific hoopla about the DB, all it is is just the lazy—excuse me, efficient—man's way of handling ratios. And the reason why it is easier to use DBs rather than the ratios themselves is that by using DBs one can add instead of having to multiply. For example:

A certain kind of cable has a loss

of 1 DB per mile. Looking at the table, we find that the power ratio of 1 DB loss is .794. Now, using DBs we find the loss of 6 miles of this particular cable as follows:

$$1 + 1 + 1 + 1 + 1 + 1 = 6 \text{ DB}$$

Now, looking at the table again, we see that a power ratio corresponding to 6 DB is .25. We could, with sufficient effort, obtain the power ratio for 6 miles of this cable, using ratios directly, as follows:

$$.794 \times .794 \times .794 \times .794 \times .794 \times .794 = .25$$

See what I mean?

The fact that a given number of DBs means a particular ratio of powers and not any absolute value of power like, for example, a kilowatt is so fundamental that I can't resist another example or two.

Let's get out of this electrical business and talk about dollars again because, if we want to, we can apply DB to dollars as well as to transmission.

Suppose you have $1000 and I have $250 and let's assume that the purchasing power of this money is directly proportional to the number of dollars. Then your dollars are 6 DB above mine because a ratio of 4 to 1 corresponds to 6 DB. If you had $10,000 and I had $2,500, you would still only be 6 DB ahead of me, because the ratio is still 4 to 1, even though the absolute number of dollars difference is 10 times as big ($7,500 against $750).

Now sometimes we do know a starting point, so that we can say: "So many DB up or down" from this starting point. (Which means such and such a ratio to the quantity with

DB TABLE

Below is an abbreviated table of power ratios versus DBs:

Number of DB	Power Ratio	
	Loss	Gain
0	1.00	1.00
.1	.977	1.02
.2	.955	1.05
.3	.933	1.07
.4	.912	1.10
.5	.891	1.12
.6	.871	1.15
.7	.851	1.17
.8	.832	1.20
.9	.813	1.23
1.0	.794	1.26
2.0	.631	1.58
3.0	.501	2.00
4.0	.398	2.51
5.0	.316	3.16
6.0	.251	3.98
7.0	.200	5.01
8.0	.158	6.31
9.0	.126	7.94
10.0	.1	10
20	.01	100
30	.001	1,000
40	.0001	10,000

The man who works with transmission uses more elaborate tables than this one, but this will give an idea of how the DB works. Note particularly that every 3 DB approximately doubles a number (or cuts it in half) and every 10 DB adds a zero to it (either in front or in back).

Note also that adding DBs produces the same effect as multiplying the corresponding power ratios. For example; 3 DB + 6 DB = 9 DB and .501 × .251 = .126 which is the power ratio corresponding to 9 DB.

Note also that a given difference in the number of DBs has the same effect regardless of where one starts. For example: going from 0 to 3 DB cuts the power in half (or doubles it); going from 3 to 6 DB does the same thing; so does going from 7 to 10 or 997 to 1000.

which we started.) When we do this, we almost always put a letter following the DB like, for example, DBm (for DB from one milliwatt), etc. (Sometimes we do not put such a letter because, after all, we have to keep *some* secrets to ourselves in this business.)

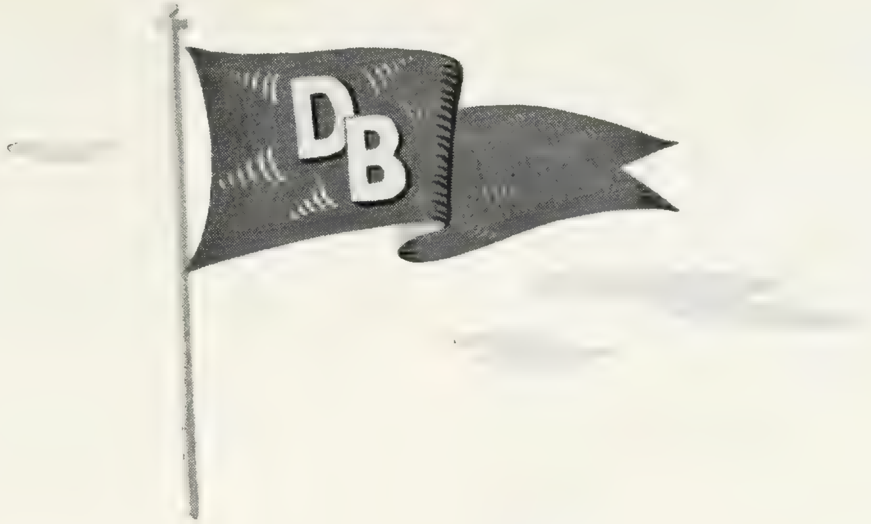
Now when we do this, our starting point is 0 DBm or 0 DBx, or 0 DB—whatever else we use, and this starting point corresponds to one unit. Thus 0 DBm means 1 milliwatt. And + means greater and — means less. Thus + 6 DBm means 6 DB more than 1 milliwatt, which by our table is 4 × 1 milliwatt or 4 milliwatts. Likewise 120 DBm is 120 DB more than 1 milliwatt and this is a trillion milliwatts or a billion watts or a million kilowatts—anyway, it's a lot of power. And — 6 DBm is 6 DB less than 1 milliwatt, which by our table is .25 milliwatts.

Maybe I can illustrate this by again using dollars. Assume that our starting point is $1 and this will be 0 DBd—DBd meaning DB from $1. Using our power ratio table, we can say something like this:

Up		Down	
DBd	Dollars	DBd	Dollars
0	$1.00	0	$1.00
+ .2	$1.05	— .2	$ .96
+ 1.0	$1.26	— 1.0	$ .79
+ 3.0	$2.00	— 3.0	$ .50
+ 10.0	$10.00	— 10.0	$ .10
+ 100	$10,000,000,000.00	— 100	$.0000000001

As this table illustrates—if you haven't discovered it by this time—the quantities associated with — DBS are the inverse of the quantities for + DBS, and vice-versa. Also, as this table shows, we often can get rid of cumbersome figures by using DBS; as, for example, using 100 DB instead of having to write 1 with 10 zeros after it.

I cannot resist one more example of how DB works. You probably know the ancient and honorable story about the guy who had the nerve to ask the ruling mogul for his daughter's hand. The mogul readily assented, provided the guy would put one grain of wheat on the first square of a checker board, two on the second, four on the third, eight on the fourth, and so on, doubling the number of grains each time. Doubling the number, of course we know by now, means about 3 (precisely 3.0103 . . .) DB. However, this was in the days before DBS were invented, or maybe the guy was not a transmission man, else he would have known long before he started that he was due to get licked. So, in his ignorance he went off to get some wheat. The first row was easy. On the first square he puts 1 grain, which we will call 0 DBg (DBg meaning DB from one grain). The second square gets about 3 DBg, the third 6 DBg,



. . . on a field of azure

and so on. The eighth square gets about $7 \times 3 = 21$ DBg; 128 grains. (If you don't believe this, multiply it out; it is $1 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 128$). The second row is not too bad. The 16th square gets about 45 DBg, which is close to 32,000. Let's cut the agony short. The 64th (and last) square must have about 3×63 DBg $= 189$ DBg—which is about 8 billion billion (i.e., 8 with 18 zeros after it) grains of wheat. Now even without counting what was on the other squares, that's a lot of wheat—probably more than there was in the world at that time and maybe even now. Anyway, even if the guy could get the wheat, before he could count out 8 billion billion he would be too old by a billion years or so to be worried about gals.

So now you know all about the DB.

You also know all about transmission. And you understand how the DB fits into the transmission business and how the transmission business fits into the telephone business. And perhaps you can better appreciate why it was, before you knew all of these things, that you had so much difficulty understanding our transmission engineer when he tried to tell you what he was driving at and how he was faring in his battle against the two DS.

Postscript

LIKE Humpty Dumpty in "Alice In Wonderland" (or is it "Through The Looking Glass"?), words mean what I choose them to mean.

And here's what I choose the words in the title of this article to mean.

The "DB" part I have already described. The "rampant on a field of azure" part I choose to mean: that combination of imagination and sweat—of keeping one's eyes on the stars and his feet on the ground—which must characterize the work of the transmission engineer if he is to continue to integrate the new things with the old in such an efficient manner that the service keeps getting better year by year and is always a bargain.

The Head of the Illinois Bell Company Addresses American Society of Safety Engineers on Their Important Part in the Country's Accident Prevention Program

Functions of the Safety Engineer in Industry

William V. Kahler

SAFETY ENGINEERING and accident prevention are subjects in which I've been very much interested for some time—although I'm sure you experts know a lot more about them than I. I suspect, however, that the main reason I'm here is that the Bell System has received the National Safety Council's Award of Honor for two years in a row—and we're certainly proud of it. However, we feel it's only a step in the right direction.

For many years we at the telephone company have had a creed that says "No job is so important and no service is so urgent that we cannot take time to perform our work safely." Now I grant you, that sounds like a slogan. It's meant to. But we look upon it as a basic human concept, backed by engineering principles. It has become our policy.

We have some 157,000 Plant men spread out across the country. They are engaged in engineering, construction, installation, and maintenance activities. These men operate trucks, derricks, diggers, plows, tractors, and other heavy power equipment, all of which present, to the untrained, a substantial exposure to accidents. They also use a variety of light power tools. They climb poles. They come in close contact with winches, cables, and high-voltage wires. Much of their work is done on busy streets or along highways, in all kinds of weather. They have to clear fallen trees and restore lines during floods and windstorms and in sleet and blizzards. The nature of the telephone business is such that we must give prompt and dependable service, not only under normal conditions but under urgent and emergency conditions as well.

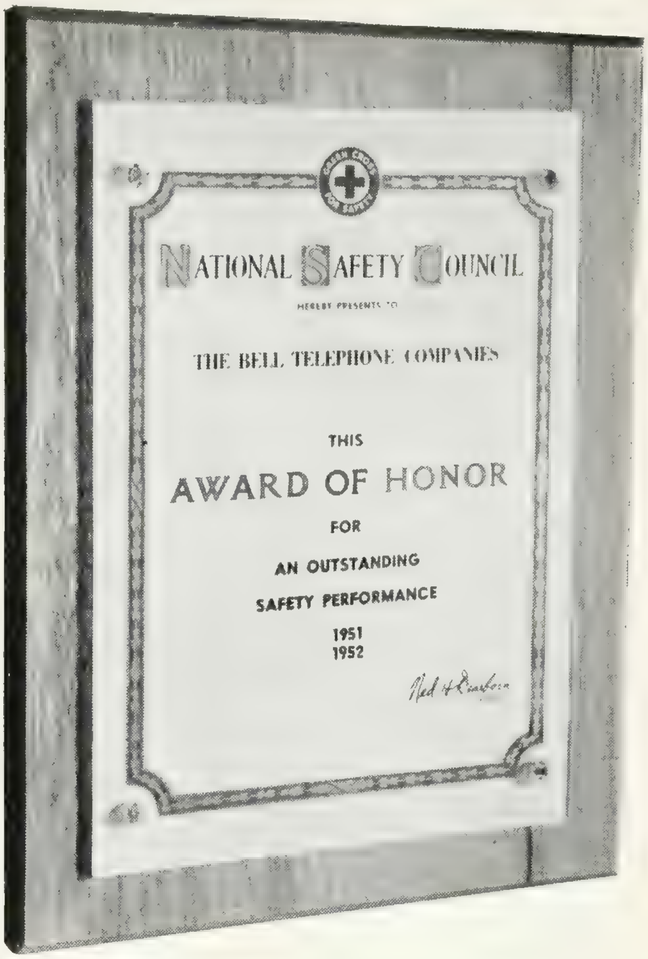
I mention these things merely to illustrate that there are some potential hazards in our business—much like those in many other businesses.

I mention them, too, to illustrate that, while we have a policy that cautions our people to take time to do their work safely, nevertheless, we must often work against time. These two situations would, offhand, appear to be in conflict with each other. But I assure you they are not. I can give you an example that proves my point:

On a winter night a few years ago, fire destroyed one of our exchange buildings just outside Chicago and 10,000 telephones, in an area of 50,000 population covering five suburban towns, went dead. Normally we would have taken a year or more to build and equip an exchange of that size. But 11 days later, complete service had been restored. Hundreds of men worked around the clock on that restoration job, and under most adverse conditions—including zero weather and a blizzard. But the job was completed without a single personal injury—and with a level of individual and team morale that couldn't possibly have been better. We proved that safety and speed can be combined—and *both* win.

Safety and Service Together

OUR APPROACH to safety is, I think, a simple and direct one. We combine accident prevention with our effort to maintain service. Safety is accepted as a part of the planning of every job, as part of the training of those who do the job, and as part and parcel of the supervisory philosophy that guides our people on the job. Stated another way, the principles of our program, for both men and women, are:



NATIONAL SAFETY COUNCIL
HEREBY PRESENTS TO
THE BELL TELEPHONE COMPANIES
THIS
AWARD OF HONOR
FOR
AN OUTSTANDING
SAFETY PERFORMANCE
1951
1952
Ned H Dearborn

The Bell System is proud to have won the National Safety Council's Award of Honor for two consecutive years

An awareness and ferreting out of the inherent hazards that go along with daily living and working.

A continuing and thorough education in how to use, safely, the tools and equipment peculiar to our industry.

An effective safety leadership in all levels of supervision.

One of the first steps in our safety program is to try to anticipate any job dangers that exist. This is accomplished through the written detailing of almost every mechanical job we do, so that hazards of the job are exposed and avoided. When we give men and women employment, we feel they have a right to expect us to point out any hazard they're likely to face in any operation they're asked to perform. We also feel they have a right to expect us to train them to avoid hazard when it exists. We regard it as management's responsibility, up and down the line, to create in the minds of employees a genuine desire to work safely.

Then we try to engineer safety into our tools, our plant, and our work methods. The safety engineering concept is folded into all of our operations and training procedures.

It seems to me that there's been a tendency to think of accident prevention almost solely from a humanitarian standpoint, with too little regard for its engineering aspects. I believe this accounts for the slow progress, until recent years, in accident prevention in industry. Every complex mechanical contrivance in use today—whether it be an automobile, a telephone system, or almost anything you can name—had its beginning in a simple machine. And development to its present state has been possible only through the application of scientific knowledge and engineering principles as they become available through research and development. I can think of no reason why scientific knowledge and engineering principles should not be similarly applied to accident prevention. Engineering, after all, is essentially the constructive use of accumulated experience. And so it is with accident prevention.

The objective of safety engineering, as I see it, is to find out how and why accidents happen and what has to be done to prevent their recurrence. I'm sure all of you safety experts know there's really little that is basically new in the way people get killed or injured. Most of the pain and suffering comes from the type of accidents that occur over and over again. We have the accumu-

Service in the River Grove, Ill., central office was completely restored in eleven days after it had been gutted by fire—and without one personal injury

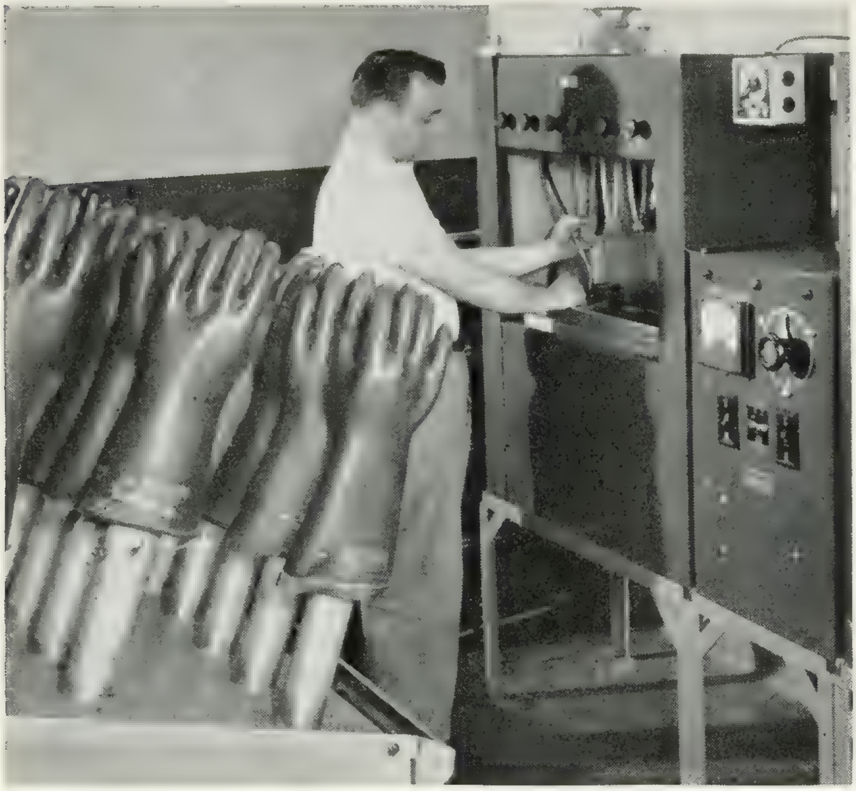
lated experience — but apparently we are not profiting from it as we should.

". . . they have a right to expect us to train them to avoid hazard . . ."

There is, however, ample evidence that this engineering concept is gaining a wider acceptance in industry. I'd like to cite one or two examples which are probably already known to you:

In 1945 the major automotive companies, machine tool builders, and industrial equipment users got together to discuss improved methods of building and installing electrical, hydraulic, and pneumatic components on machine tools. The standards that resulted from this coöperative effort were not something the law required. They came about through the initiative of private industry. And the remarkable thing about the adoption of those standards was that, along with a better safety environment for employees, they brought gains by way of uninterrupted production, longer equipment life, and reduced equipment maintenance.

In another specific case, an automotive plant had several hundred large presses that were loaded, unloaded, and operated by hand. To eliminate the possibility of amputation, the company adopted a policy of prohibiting any part of the operator's body being put between the punch and the die. Dies and other equipment had to be redesigned—which was costly. This company's primary objective was to protect its employees. And in this it succeeded—for the change brought a decided improvement in the plant's safety record. But it also brought increased production and a decrease in scrap. By keeping arms, fingers, and hands out of the danger zone, it was found that presses could run continuously instead of intermittently. Efficiency was increased, costs were cut. Again, what started out to be only a matter of making the job safer turned out



Lineman's rubber gloves are tested to 10,000 volts by the Western Electric Company, the Bell System's manufacturing and supply unit

to be a matter of good business as well.

It's not enough, of course, to have safe practices. Just as important is having folks assigned to a job understand safe practice and *know* the job's danger points—and then training them to perform the job in a safe manner. Training and safety are interwoven. The basis of our whole philosophy in the Bell System is that the *safe* way to do a job is the *right* way.

Then why do we continue to have accidents? It is not because of any failure to engineer safety into the job but rather, in my opinion, because of uninspired attitudes. It is possible to cause spectacular improvement in safety results by working on attitudes—by promoting a real consciousness of safety. This was principally the approach utilized in some results I'm going to cite. It proves it works for women too—women working in office environments—and we found out that we don't have to be experts in female psychology to get results. (I take it the safety expert has to be a journeyman psychologist, a salesman, an engineer, all in one.)

In 1946, the accident rate in one group of women employees in our Company, mostly switchboard operators, was ten per one thousand employees. A program of stressing the environmental aspects of safety—of making this group aware of daily hazards through *participation* in committees discussing accident occurrences—was inaugurated. The result: during the last four years, the accident rate of ten per one thousand has dropped to .65 accidents per thousand employees. Each year 90 women employees in this group, or between 300 and 400 for the four-year period I mentioned, have been saved pain and suffering as a consequence of this coöperative effort.

Basically this job of selling a safety attitude was done by good supervision inspired by top management suggestion. And good supervision, with respect to safety or anything else, consists of understanding and working harmoniously with people—the same elements that produce good service.

Supervision and Leadership

THE AIM of good supervision in safety activities is always to provide positive and effective leadership so that the group will want to work safely and respond coöperatively toward eliminating accidents while at work. At the telephone company, we feel that safety training is one of the supervisor's most important duties—from the president right on down through all levels of the organization. In short, the supervisors of the supervisors are expected to be always on the alert to promote safety. Our top supervisors—in fact our entire staff—are schooled to believe that a *safe* worker is the *best* worker.

Now the causes of haste, carelessness, abstraction, forgetfulness, or poor attitude—all behaviors which may lead to accidents—can be known to a supervisor if he or she is wise and observing enough to build a solid foundation of understanding with each of his or her people. By recognizing these human behavior factors before they cause accidents, supervisors can devote their efforts to *preventing* accidents rather than to making reports of them after they occur. It doesn't do much good to tell people that they must have a safe attitude. A correct attitude toward safety must be built into them by a series of satisfying, helpful, everyday observations and suggestions, persuasively passed along by supervisors at all levels.

On the other hand, a person may be taught how to do a job safely and wind up doing it unsafely tomorrow. Years of job experience or a careless familiarity with surroundings have a tendency to cause some people to develop contempt for a practice that has come to appear tedious to them. To minimize this tendency, our training aim is not only on *how* to do a job, but *why* it must be done that way. And then, by repetition, fix details of a procedure so firmly in people's minds that it becomes habit-forming—so habit-forming that they will rebel against doing it any other way.

Safety Observation Plan

A VERY important step in our safety program is a sort of check-up. For

Testing the holding power of a strand puller, an essential tool for tensioning cable supporting strands, at Bell Telephone Laboratories

"Bill Spec" (above) and "Miss Haps" (below) are frequent reminders to employees of the need for constant vigilence

a long time the Bell System checked work quality, such as the installation of a telephone, by inspecting the job after it was done. That procedure was all right as far as it went. It enabled the foreman to find out whether all physical work was done that should have been done and in a workmanlike manner. But it left out one very important thing: it didn't tell him *how* the job was done, or whether the man worked safely and efficiently while he did it.

We improved on this "quality" inspection some years ago when we introduced what we call the Safety Observation Plan. This plan provided not only "quality" intelligence, but "safety" intelligence as well. Under this new plan, supervisors directly responsible for the safety of their men make observations of work while it's in progress. These observations cover the use of tools, material, and equipment. They are directed toward the detection of any unsafe work procedure followed in performing the work—including job planning in the light of circumstances and conditions surrounding the particular job being done—all with a view toward uncovering any failure to recognize accident potentials. When the supervisor observes an unsafe work practice, he discusses it with the man involved. If necessary he reviews with the man the written details that cover the job being done. He makes a record of the unsafe practice and if, in his judgment, the man needs it, the supervisor gives him additional special training to correct his shortcomings. So you see, our safety training program really never stops.

Records of these observations are forwarded through lines of organization, where they're studied, summarized, and discussed at supervisory and employee meetings held at regular intervals. This information is put to practical use in several ways.

First, it is used to assist in determining the real underlying causes of unsafe habits—to help us anticipate

Posters for employees and statistical studies and brief reports of how accidents happen are parts of the Bell System's consistent approach to the safety program

dangers of the job. Then, it may suggest the need for a re-design of educational and training projects for certain groups doing certain jobs. It may call for improvement in job procedure, better safety codes, and may lead to design improvements in tools, equipment, and environmental surroundings—calling on our engineering knowledge again. It may indicate the need for additional supervisory attention on certain kinds of work, or it may call for a change of emphasis in the safety program itself.

Engineering Accident Prevention

The Safety Observation Plan is just one of the ways we're applying engineering procedure to accident prevention. It's one of our means of utilizing accumulated past experience. In short, it's safety engineering with a practical touch. We know our safety engineering has been an important factor in improving our safety performance. And we regard it as good business, because it contributes to job efficiency and operating economy. But, even more important, it helps keep our folks from getting hurt. . . .

Four years ago the Labor Management Committee of the President's Conference on Industrial Safety set forth these principles, and I think they're worth repeating here:

Accident prevention is the legal *and* moral *obligation of the employer, and management must have* *the authority necessary to carry out this responsibility.*

It's the moral *and* personal *obligation of each individual employee to coöperate in the safety program.*

In unionized plants, the welfare of the employees places upon the union a moral obligation to coöperate in accident prevention within the framework of its agreed-upon participation.

I'm sure all management recognizes the soundness of those principles, and accepts their part of the responsibility for seeing that they're effectively and consistently applied. I think labor, organized or not, feels the same way about it.

And that's where you safety engineers come into the picture. I won't presume to tell you how you should go about your work; but it seems to me that one of your basic problems is to get across to top management the idea that safety cannot be considered separate and apart from the production job. This "one job" concept was spelled out most convincingly, I think, by Mr. Weiser* in his article on "The Place of Safety Engineering in Industry."

Mr. Weiser points out that industry—*any* industry—has only one job, and that the three elements of that one job are quality, quantity, and accident prevention. He goes on to say that all three of these elements spring from the same production factors: careful planning, thorough training, and effective supervision. Then he maintains that it's up to the safety engineer to search for the real causes of accidents, to tap the fountain of knowledge of past experience, to bring to management the means for tapping that fountain and translating it into effective action.

While it's true that safety engineering is one of the newer vocations aiming toward professional status, I don't think that's any reason for discouragement. I heartily agree with Mr. Weiser when he says that if you safety engineers are to find your rightful place in industry, if you're to achieve real professional status, you must do your job so well that industry will find it impossible to get along without you. You have a real selling job to do—but I think you're well on your way toward the kind of recognition your high calling merits.

From whatever standpoint you look at it—humanitarianism and morale building or as an aid to greater industrial efficiency—the importance of your function is so great that wise industry will in no sense long do without your services.

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* C. H. Weiser, Plant Personnel Supervisor, Southwestern Bell Telephone Company, Topeka, Kans., and President of the American Society of Safety Engineers.

Twenty-five Years Ago in the BELL TELEPHONE QUARTERLY: *From Volume VIII Number 1, January, 1929*

Announcement of the transatlantic telephone cable reminds us that transatlantic radio telephone circuits were still being placed in service a quarter of a century ago—with elaborate ceremonies. The following is excerpted from an account of the opening of service between this country and Spain. EDITOR.

TELEPHONE SERVICE between North America and Madrid was inaugurated by conversations between President Coolidge and King Alfonso XIII on October 13. The ceremonies at Washington took place in the directors' room of the United States Chamber of Commerce. President Walter S. Gifford of the American Telephone and Telegraph Company acted as master of ceremonies at Washington, while Colonel Sosthenes Behn, President of the International Telephone and Telegraph Corporation, acted in a similar capacity in Madrid.

Addressing King Alfonso, President Coolidge said: "I welcome this added link, no less strong because it is invisible, between Spain and the United States. I believe it to be true that when two men can talk together the danger of any serious disagreement is immeasurably lessened and that what is true of individuals is true of nations. The international telephone, therefore, which carries the warmth and the friendliness of the human voice, will always correct what might be misinterpreted in the written word . . ."

King Alfonso, speaking in English, replied:

"I heartily reciprocate in my own name, and in that of Spain, the greetings of Your Excellency.

"Mr. President: I thank you for the cordial words in which you do Spain the honor and justice to recognize her outstanding services to the Americas, and I agree that we ought to expect from this new means of communication ever closer relations because of the intimate and more perfect understanding between the two peoples.

"I reiterate to Your Excellency with my salutations, the testimony of my most sincere appreciation, and extend best wishes for the peace and prosperity of the United States."

J. Reuben Clark, Assistant Secretary of State, spoke in behalf of the State Department at Washington. His greeting was acknowledged by Ambassador Ogden H. Hammond, speaking from Madrid, as follows:

"It is a great honor to be the first American Ambassador to Spain to communicate with the Department of State by means of this wonderful invention of wireless telephony, which brings Spain and the United States so close together . . .

One Executive to Another

GREETINGS were also exchanged between President Walter S. Gifford and the Marques de Urquijo, President of the National Telephone Company of Spain. Mr. Gifford said:

"Although I have been in the telephone business all my life, I confess it gives me a thrill to talk over the lines of four countries, through the air over the ocean, under the sea by cable, over the Pyrenees, and to get from you in a fifth of a second a message from the country whence Columbus started upon his momentous journey, based on the belief that the world was round . . .

The Marques de Urquijo replied:

"Thanks to the co-operation of the French Post Office, through whose territory we pass, and the co-operation and facilities of the British General Post Office with its Rugby Radio Service, it has been possible for his Majesty the King to greet the President of the United States and inaugurate the telephone service between Spain and the United States. It is also my privilege to greet you, Mr. Gifford, as President of the great American Telephone and Telegraph Company, which company has been a constant inspiration in the development of our Spanish Telephone Company over which I have the honor to preside. May I extend to you and your colleagues my most cordial salutations."

Who's Who & What's What

(*Continued from page 191*)

The Bell System works closely with the latter organization, and is much interested in the award by Congress last year (1953) of a national charter to the National Safety Council. Mr. Kahler's first telephone job was with the Southwestern Bell Telephone Company in 1922, succeeded shortly after by one in the Engineering Department of the Western Electric Company—predecessor of the Bell Telephone Laboratories. From 1924 to 1930 he was with the Engineering and Plant Departments of the Illinois Bell Telephone Company, and from 1930 to 1937 in the O. & E. Department of the A. T. & T. Company. Mr. Kahler became chief engineer of the Chicago area of Illinois Bell in 1938. Two years later he accepted a series of government assignments which included that of director of the Bureau of Construction of the W.P.B. Returning to the company in 1943, he became assistant vice president and then general manager, State Area; vice president in charge of operations in 1946; and president of the company in 1951.

Transatlantic Cable

(*Continued from page 226*)

along the same coaxial conductor. The cable will be protected by a wrapping of copper foil, over which there will be a heavy cover of jute and steel wires.

Agreement for construction of the cable has been signed by A. T. & T., the British Post Office (which provides telephone service in Great Britain) and the Canadian Overseas Telecommunication Corporation (which furnishes overseas communications for Canada). It will be owned jointly by these three organizations. The project will take three years to complete and will cost $35 million.

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I am not sure when it was that the idea of providing the best possible telephone service first became rooted in this business—in the minds of telephone people. I do know it was flourishing forty years ago, when I started, and I imagine it goes back quite a while before that. It is a wonderful idea—a necessary idea—and, as we know, it is the foundation of all our efforts.

Recently the Directors of the A. T. and T. Company expressed it this way:

"We think it all important," they said, "that we furnish the best telephone service it is in our power to provide—a service high in value and steadily improving—at a cost to the user that will always be as low as possible and at the same time keep the business in good financial health."

To me that is a good clear statement.

But the meaning is equally clear when one of us says to himself,

"On that call I did everything I could possibly have done;"

And when another says, "That's the smoothest, neatest job I ever turned out;"

Or, "Brother, we're really giving service these days, and I don't mean maybe."

Now there are no two ways about it: doing our best is demanding. It simply will not come easily. But it pays its own dividends. For it sharpens our competence. As we make a habit of doing our best, we acquire talents that we would not want to be without. And beside gaining in skill, I am sure we also gain in character—in our stature as human beings.

From an address by A. T. & T. President Cleo F. Craig to the Telephone Pioneers of America on September 19, 1953.